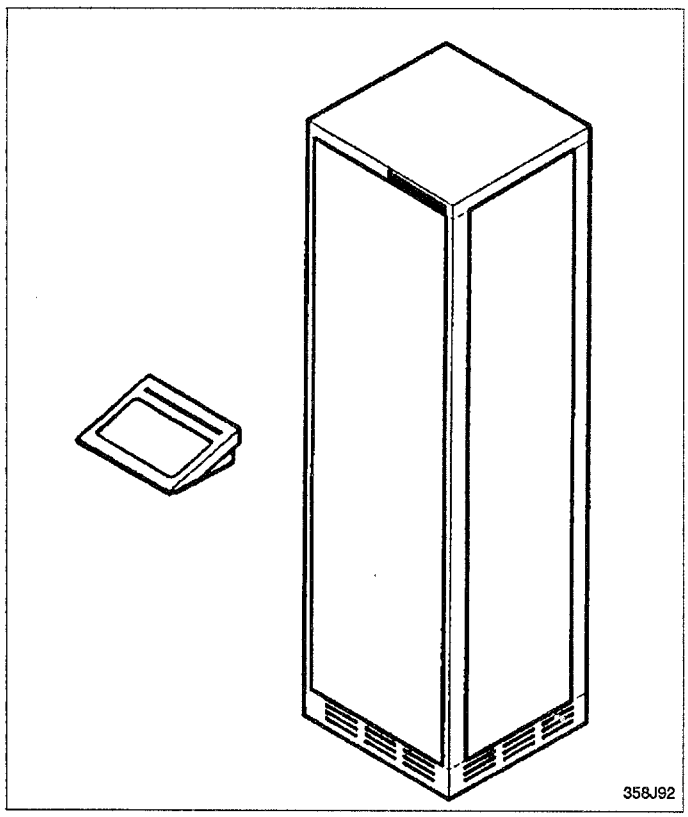
PHILIPS

Philips Medical Systems

SERVICE MANUAL
742
SUBSYSTEM

OPTIMUS 50/65/80

9890 000 02111	50 kW	– 1 tube
9890 000 02121	50 KW	– 2 tubes
9890 000 02131	65 kW	– 1 tube
9890 000 02141	65 kW	– 2 tubes
9890 000 02151	80 kW	– 2 tubes



CAN–controlled X–ray generator of the converter type

PMC Hamburg

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Federal Republic of Germany
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Manual Order No. 4512 103 58272

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SERVICE MANUAL- SUBSYSTEM Author: B. Freytag

OPTIMUS Techn.No:

Type No: 9890 000 02111	50 kW - 1 tube	Basis	4512 104 70202
Type No: 9890 000 02121	50 kW - 2 tubes	Basis	4512 104 70202
Type No: 9890 000 02131	65 kW - 1 tube	Basis	4512 104 70601
Type No: 9890 000 02141	65 kW - 2 tubes	Basis	4512 104 70601
Type No: 9890 000 02151	80 kW - 2 tubes	Basis	4512 104 70601

Release: 0

In case there are any questions concerning this manual,
please send this LOPAD via fax to 49/(0)40/5078 2481

File: OPTIMUS 50/65/80_1_ 941E_INH
File: 4512 103 58272.a942

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[1] = 4512 982 00751

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(nur für Fabrik Auslieferung)

Service software No: 4512 152 04753

XRG_SCOPE 1 (/94.1) E

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Author: B. Freytag
GSI22

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OPTIMUS **PLANNING DATA**

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1. Product information

The OPTIMUS family of generators for radiography is based on computer–controlled converter technology.

The converter operates in the non–audible frequency range.

Applicational options are essentially achieved by releasing software modules using customized PAL ICs.

Control between the internal function units (FUs) and the external online equipment takes place via a CAN bus.

Safety–relevant signals are transferred directly on the so–called signal bus.

Units without any CAN interface are operated via the "Adapter decade cable" option.

1.1 Applications

- Radiography
- Tomography

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1.2 Options

– Mains transformer 400 ... 480 V, 50/60 Hz, also for 400 V mains supply without neutral lead N with taps for 400 / 440 / 460 / 480 V	9890 000 02301	
– Low–speed rotor control	9890 000 02201	
– High–speed rotor control	9890 000 02211	
– Automatic input of tomo times	9890 000 02221	
– Tomo density control	9890 000 02231	
– VARIO FOCUS	9890 000 02271	
– Adapter decade cable for 4 aux. units	9890 000 02311	
– Option rack	9890 000 02321	
– Adapter AMPLIMAT cable 3+/D–Sub	9890 000 02331	
– Operating panel	9890 000 02401	
– Stand for operating panel	9890 000 02441	
– Wall mounting of operating panel	9890 000 02451	
– 230/24 V Adaptation for release circuits	9803 430 23002	
– Decade cable set	9803 704 20102	
– Extension set for one additional tube	9803 709 20002	
– Mains transformer 190 ... 390 V, 50/60 Hz with taps for 190 / 200 / 207 / 220 / 230 / 240 / 250 / 343 / 380 / 390 V	9803 720 81002	max. 50 kW!

2. Compatibility

2.1 Versions

. . . of the X–ray generator family OPTIMUS 30/50/65/80/100 9890 000 02001

– 50 kW generator for 1 tube:	OPTIMUS 50	9890 000 02111
– 50 kW generator for 2 tubes:	OPTIMUS 50	9890 000 02121
– 65 kW generator for 1 tube:	OPTIMUS 65	9890 000 02131
– 65 kW generator for 2 tubes:	OPTIMUS 65	9890 000 02141
– 80 kW generator for 2 tubes:	OPTIMUS 80	9890 000 02151

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2.2 Tubes

Recommended standard tubes:

RO 17 50
SRO 25 50
SRO 33 100

Further compatible tubes:

RO 12 30
RO 30 50 RE
SRO 13 30
SRO 20 50
SRO 33 101

Compatible tube housings:

ROT 350
ROT 351

Current information on further tubes to be connected is available at the service center Hamburg.

3. Mechanical data

Installation dimensions and weights: see drawing Z–1

Transport data:

	Weights (kg)		Dimensions (cm)		
	net	gross	length	width	height
Case 1: Contents: generator cabinet	178	226	210	82	84
Case 2: 1–tube version 2–tube version Contents: H.V. generator	73 88	100 115	77	67	80

4. Environmental data

according to PMS standard UXW 13600

4.1 Climatic conditions

Ambient temperature:	10 ... 40 °C
Relative humidity:	15 ... 90 %, no condensation
Relative atmospheric pressure:	70 ... 110 kPa

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5. Electrical data

5.1 Power data and mains conditions

	50 kW	65 kW	80 kW
Power data:			
Mains voltage	3 × 400 V ±10%		
	3 × 400/440/460 V ±10% 3 × 480 V −10%, +6% } with internal transformer (option)		
	3 × 190...343 V ±10% with external transformer, max. 50 kW (option)		
Mains frequency	49 ... 61 Hz		
Max. mains current			
– at 400 V	145 A	190 A	230 A
– at 440 V	135 A	180 A	215 A
– at 460 V	125 A	170 A	210 A
– at 480 V	120 A	160 A	205 A
– at 190 V	300 A	–	–
Fuse protection (slow-blow)	35 A 100 A at ≤ 240 V	50 A	
Mains resistance			
– at 400 V	≤ 300 mΩ	≤ 200 mΩ	
– at 440/460 V	≤ 350 mΩ	≤ 240 mΩ	
– at 480 V	≤ 400 mΩ	≤ 300 mΩ	
Unit supply	230 V / 400 V, max. 5 A		
Max. output power	50 kW	65 kW	80 kW

5.2 Operating data

	50 kW	65 kW	80 kW
Tube current	10 ... 650 mA	10 ... 900 mA	10 ... 1100 mA
Tube voltage	40 ... 150 kV in 1 kV or % steps		
mAs product	0.5 ... 850 mAs		
Exposure time	1 ms ... 6/16 s		
Exposure sequency	≤ 12 exp./s		
Noise level	≤ 40 dBA		
Heat dissipation	500 W		

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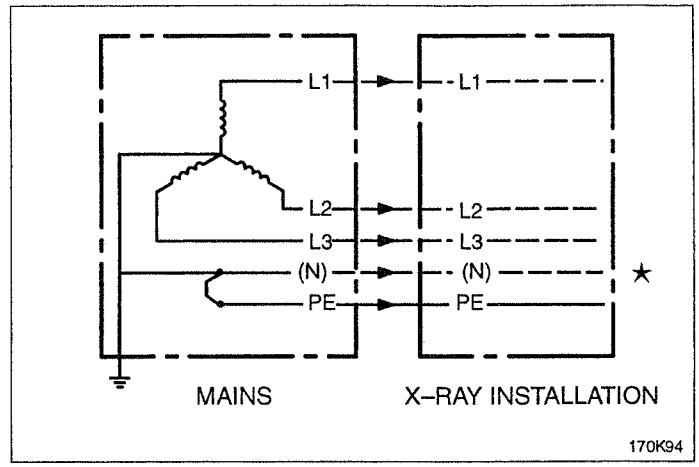
5.3 Power supply

5.3.1 Type of power supply



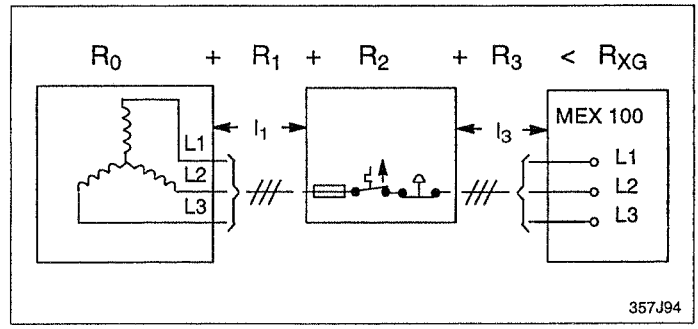
Standard connection:
- 3 phase wye
- 400 V
- Neutral, earthed (★ not required if the mains transformer 9890 000 02301 is ordered)
- Earth

Connection with the internal mains transformer 9890 000 02301 (option):
- 3 phase wye or delta
- 400 / 440 / 460 / 480 V
- Earth, balanced

Operation on three–phase mains that are unbalanced to earth (e.g. with one phase earthed) is impermissible unless adequate adaptation measures have been taken!

Check that the sequence of phases in the wall junction box is correct corresponding to the designations L1, L2, L3.

5.3.2 Calculating the mains resistances



If possible, the sum of R_0, R_1, R_2 and R_3 should be smaller than the R_{XG} required.

With higher internal mains resistances the generator output is reduced respectively.

Note that the cross section of lead l_3 must not exceed 25 mm^2.

- R_0 designates the mains resistance on the distributor transformer.
- R_1 is dependent upon the length of lead l_1 between distributor transformer and main distributor and upon the cross section selected, so:
  $R_1 = l_1 \times R_{Cu}$ R_{Cu} from table
- R_2 is estimated to be 15 mΩ
  - EMERGENCY–OFF switch 4 mΩ
  - Earth–leakage circuit breaker 5.5 mΩ
  - Fuse 5.5 mΩ

  } 15 mΩ
- R_3 is dependent upon the length of lead l_3 between main distributor and wall junction box and upon the cross section selected, so:
  $R_3 = l_3 \times R_{Cu}$ R_{Cu} from table

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The resistances already consider the go and return line so that the calculation can be based on simple cable lengths.

Copper cross section [mm^2]	Resistance R_{Cu} [in mΩ/m]
16	2.19
25	1.4
35	1.0
50	0.7
70	0.5
95	0.38
120	0.30
150	0.24

5.3.3 Earth–leakage circuit breaker

To be provided between fuse and X–ray installation depending upon local regulations.

Siemens earth–leakage circuit breaker:

Order No. 5 SZ 3466

Rated fault current 30 mA

Rated current 63 A

Connection terminals for wire cross sections of up to 25 mm^2.

5.3.4 EMERGENCY–OFF device

To be provided depending upon local regulations.

There are 2 possibilities:

1. All the EMERGENCY–OFF buttons are connected in series and looped into the starting circuit (12 V DC) of the generator.
2. The EMERGENCY–OFF circuit acts on an external main contactor which switches off the power before it is fed into the generator.

6. Tools

In addition to the standard tools the following are required:

- Service–PC
  IBM– compatible, 640 kB RAM, 3.5" floppy disk drive, ≥ 1 serial port
- 0–modem cable
  Male 9–pole D–Sub connector at the generator end.
- Installation and service software 4512 152 04751 supplied on a floppy disk with the generator.
- PC–Hardkey (DIAGGEN) to use the installation and service software.
- Mains resistance measuring instrument.

7. Traceable items

- X–ray control (generator cabinet, operating panel)
- H.V. generator

The items are assigned the same series number when delivered ex factory.

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8. Preparation

Connection of the generator:	see drawing Z–3
Operating panel:	see drawing Z–5
Connection diagram:	see drawing Z–7.1/2/3
Earthing diagram:	see drawing Z–7.4
Legend:	see drawing Z–7.5

8.1 Installation materials

To be ordered from the service department via PMS Hamburg:

– Wall junction box 4512 103 75384
inclusive connection block (25 mm^2) for mains supply and connection block (10 mm^2) for unit supply.

8.2 Cables

– **H.V. cables** 9806 402 6xx02

plugs:	O3/O3
length:	6 ... 20 m in steps of 2 m
capacity:	155 pF/m
diameter:	16.5 mm

The cable length is indicated at the 9th and 10th digits of the code No.

– **Thermal contact cable**
2–wire screened for 1 excess temperature switch 0722 215 01017 or
10–wire screened for additional supervision like 0722 215 19005
temperature alarm switch, buzzer, selection indicator.

– **Stator cable** 3 × 1.31 mm^2, screened 0722 215 02054

– **AMPLIMAT cable** with 3 PLUS plugs
8...28 m 9803 507 0xx02
The cable length is indicated at the 9th and 10th digits of the code No.
AMPLIMAT cables with 3PLUS plugs can be connected in the generator via the following adapter for each cable.
Adapter for measuring chamber cable 9800 000 02331
(contained in the accessories; 2 items for 1–tube–version, 3 items for 2–tube–version)
or

– **AMPLIMAT cable** with D–Sub and 3 PLUS plug. Only suitable for ALC–measuring chambers.

12 m	9890 000 01721
16 m	9890 000 01731
20 m	9890 000 01741
24 m	9890 000 01751

– **Operating desk cable set**

10 m	9890 000 02411
20 m	9890 000 02421
30 m	9890 000 02431

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8.3 Manpower

At least two persons to insert the H.V. generator, which weights about 110 kg, in the generator cabinet.

9. Planned maintenance

The technical documentation for carrying out maintenance work in compliance with the applicable regulations are available at the responsible authority of Philips Medical Systems.

The importance of having maintenance implemented is pointed out to the operator in the operating instructions.

It must be guaranteed that the person carrying out maintenance work knows about the respective national regulations and that this person observes these regulations throughout all steps of maintenance work.

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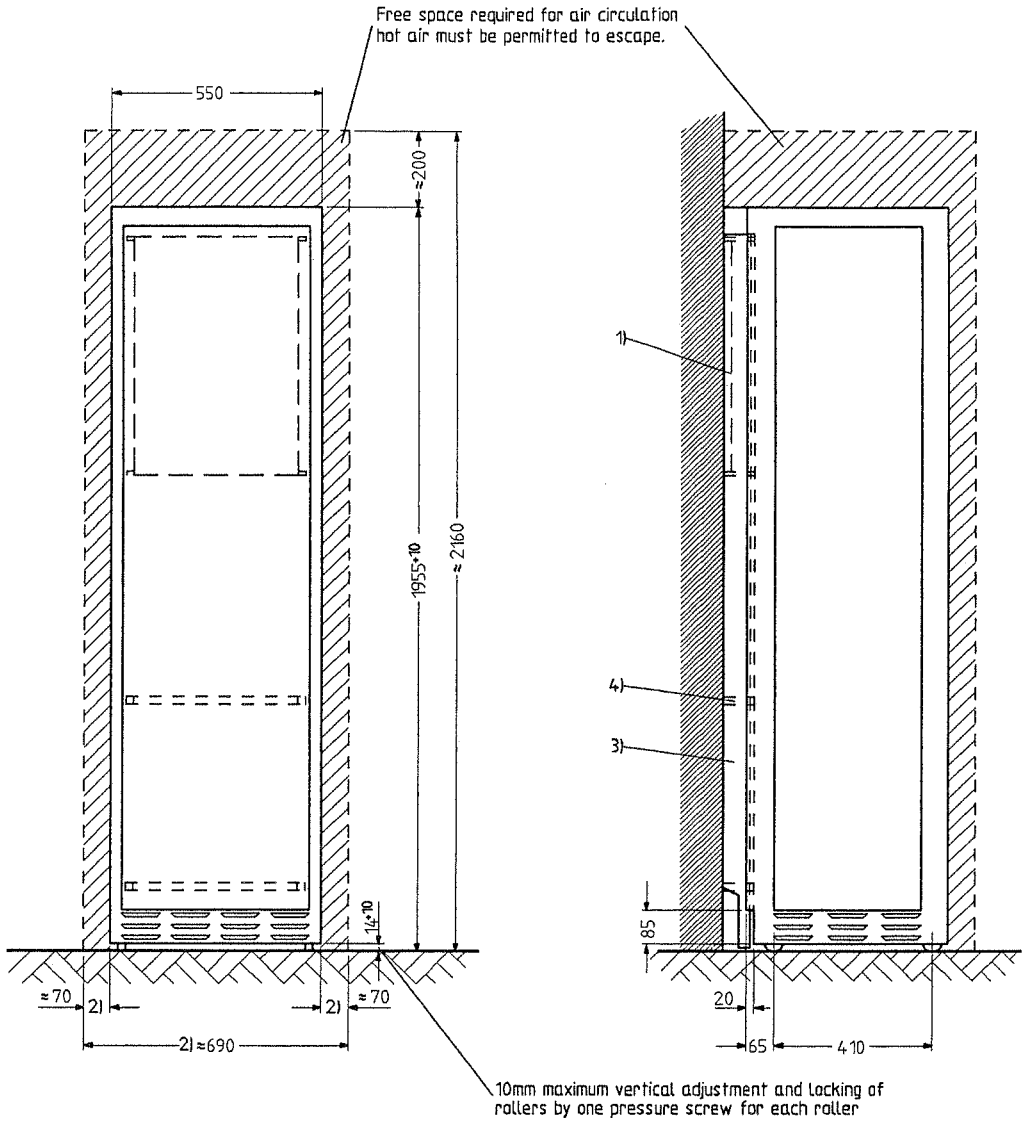

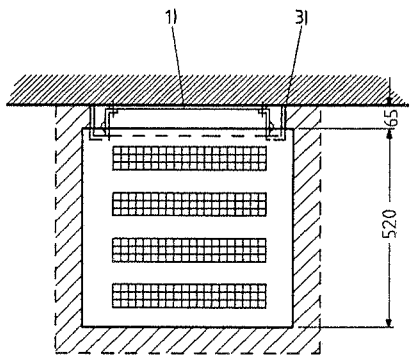

1) Wall junction box

2) Lateral clearance unless there is an adjacent cabinet

3) Filler panel

4) Wall-cabinet spacing angle

weight : 210 kg

A2/A4 94-09-22 Schr
u00614

Dimensions and weight

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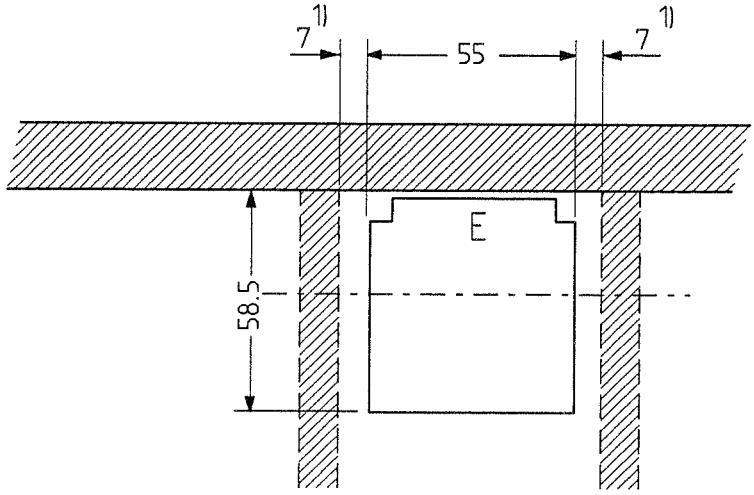
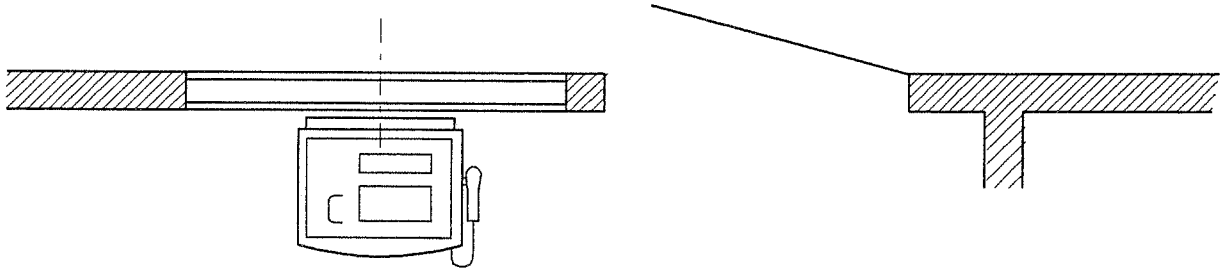


1) With no other cabinets beside them

E= Control cabinet

C= Operating desk



scale 1:20 measures in cm

PRB-XRD products

A4 94-09-21 Schr.
u00670

Overlayer for room layout

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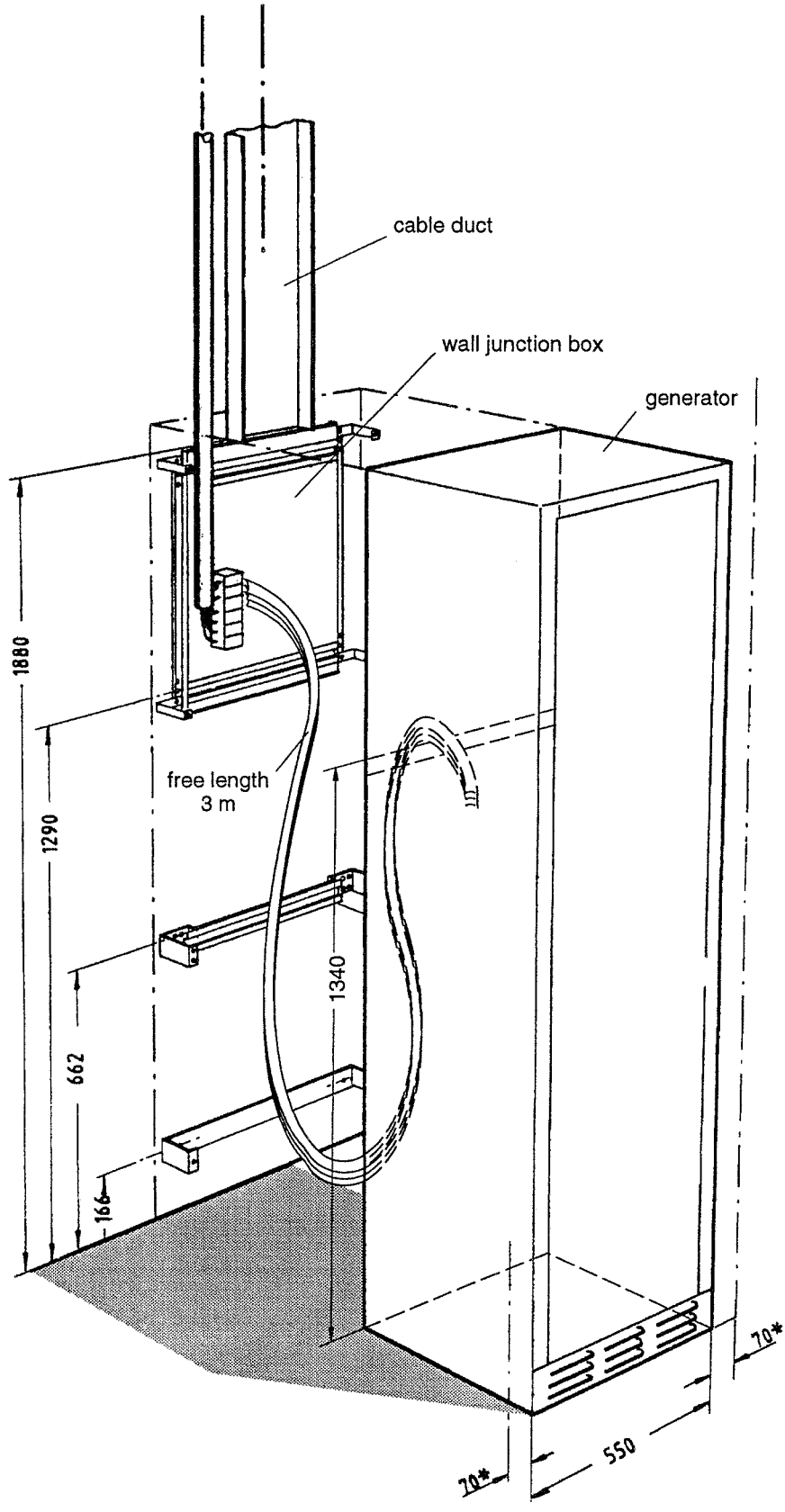

*) Space with no other cabinets beside them.

PRB-XRD producets

A4 94-09-22 Sie.

PRB_4512_982_00751_Z3

Connection of generator

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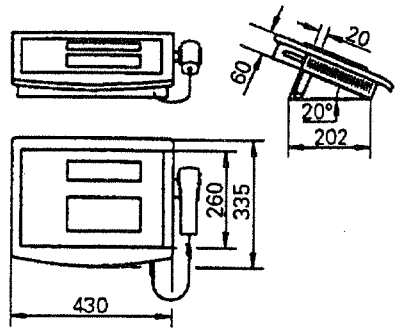
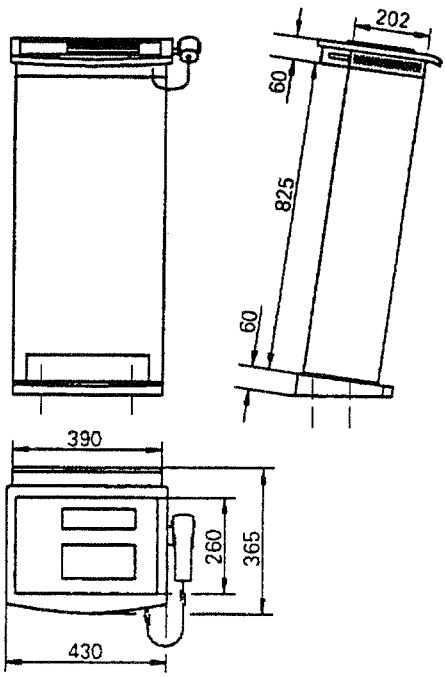
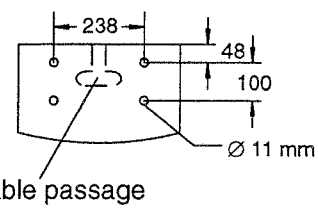
① Low profile control desk



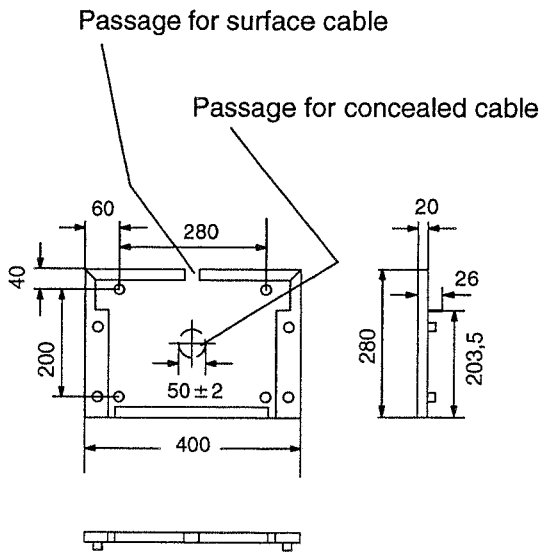
② Stand for low profile control desks



mounting drillings in the bottom of the stand



③ Wall–mounting support



Weight ≈ 2kg

PRB–XRD products

A4 94–09–22 Sie.

PRB_4512_982_00751_Z5

Operating panel

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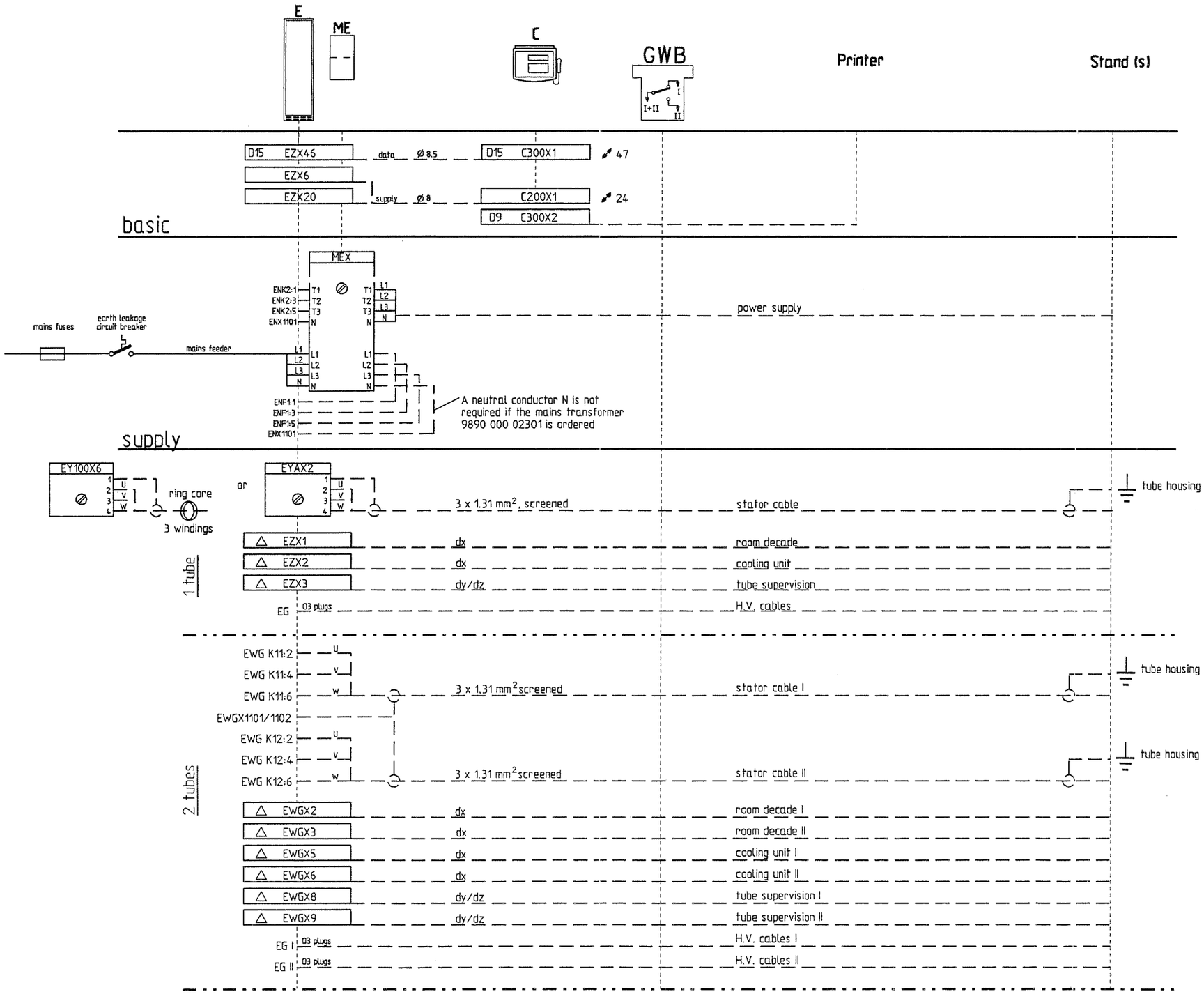

PRB-XRD products

A2/A3 94-12-01 Schr./Ost.
u00616

Connection diagram

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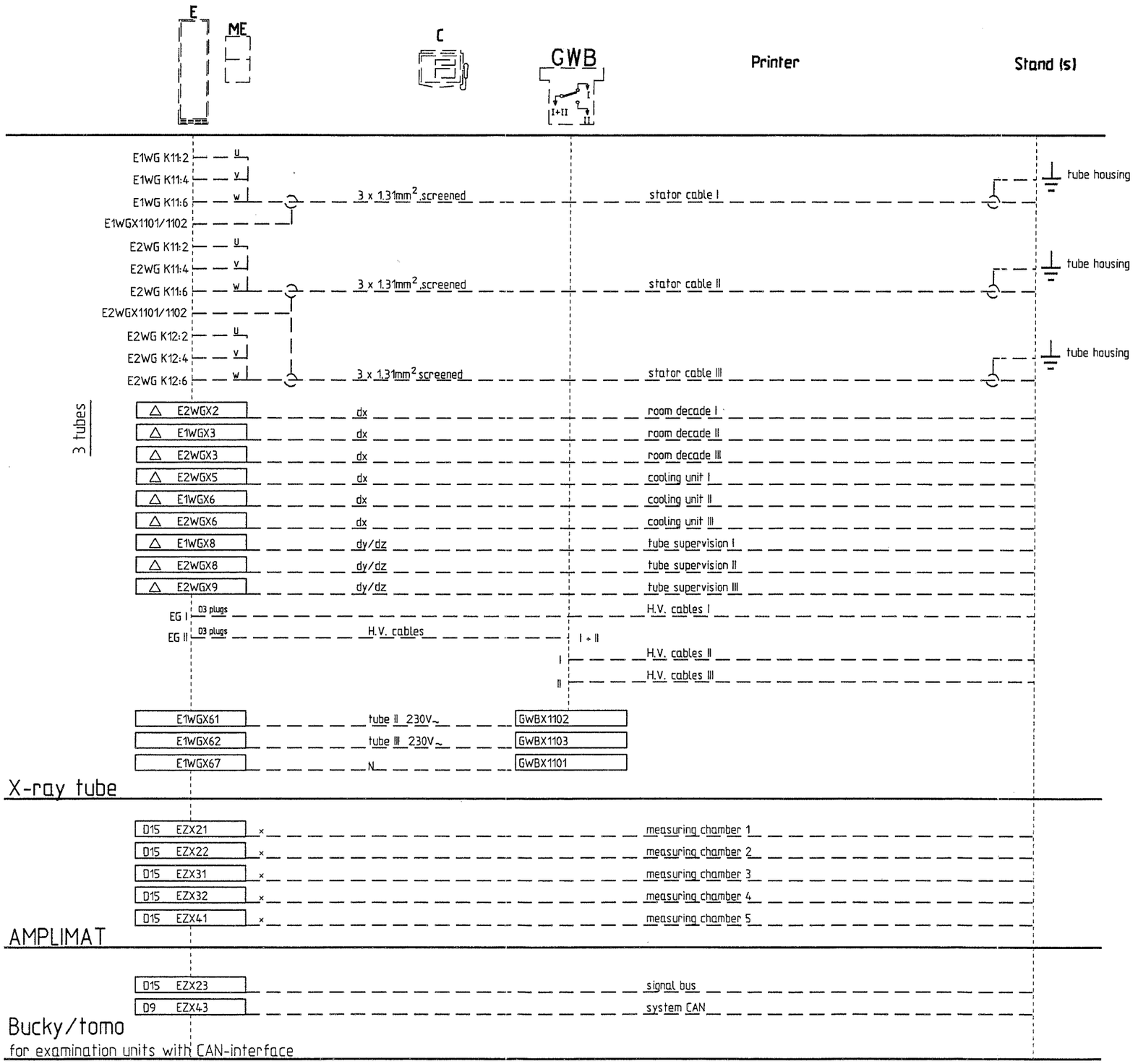

× Adapter from 3 PLUS to Sub-D connector incl. 40V generation for measuring chamber supply is available.

PRB-XRD products

A2/A3 94-12-01 Schr./Ost. u00616

Connection diagram

Z-7.2

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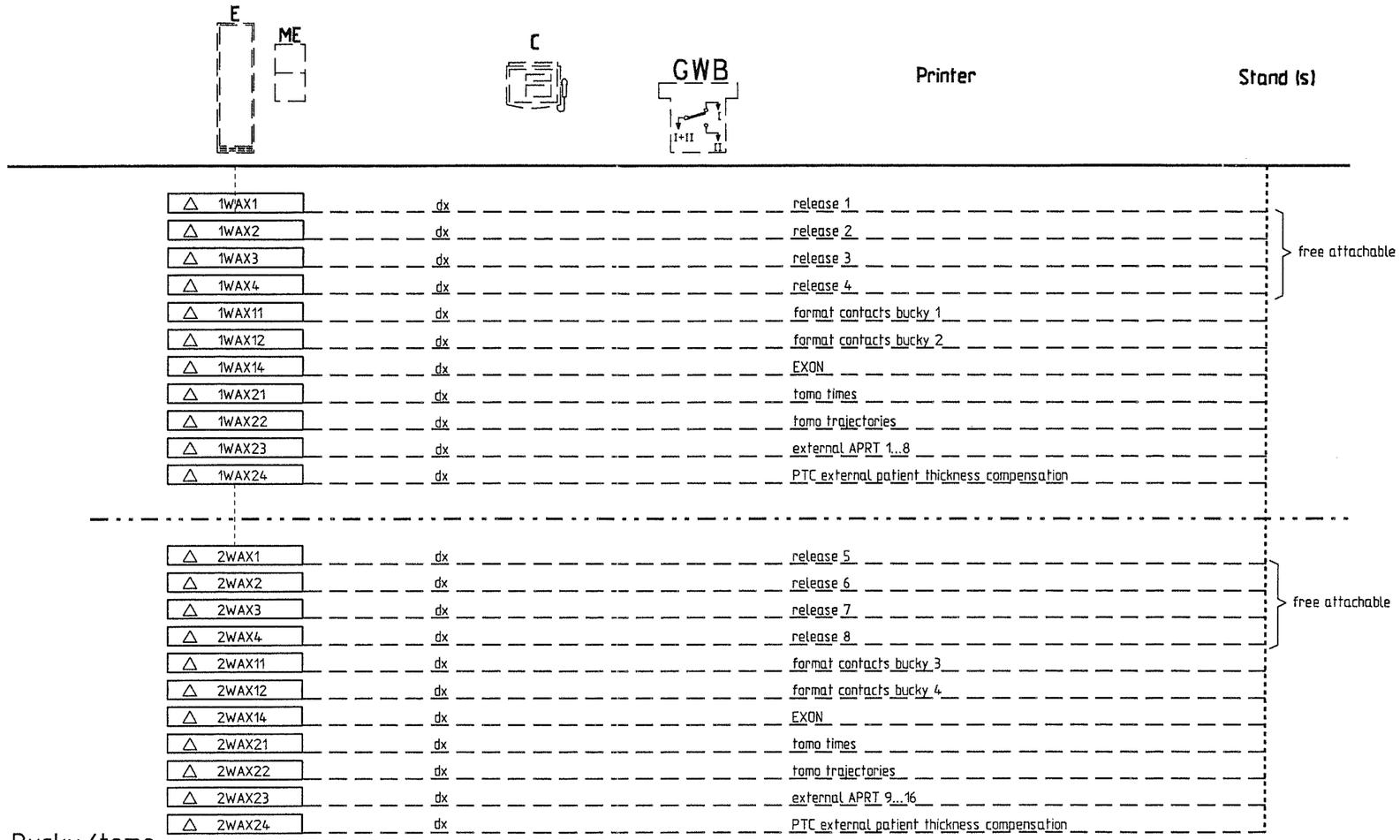

Bucky/tomo

for examination units without CAN-interface

A2/A3 94-09-22 Schr.
u00616

Connection diagram

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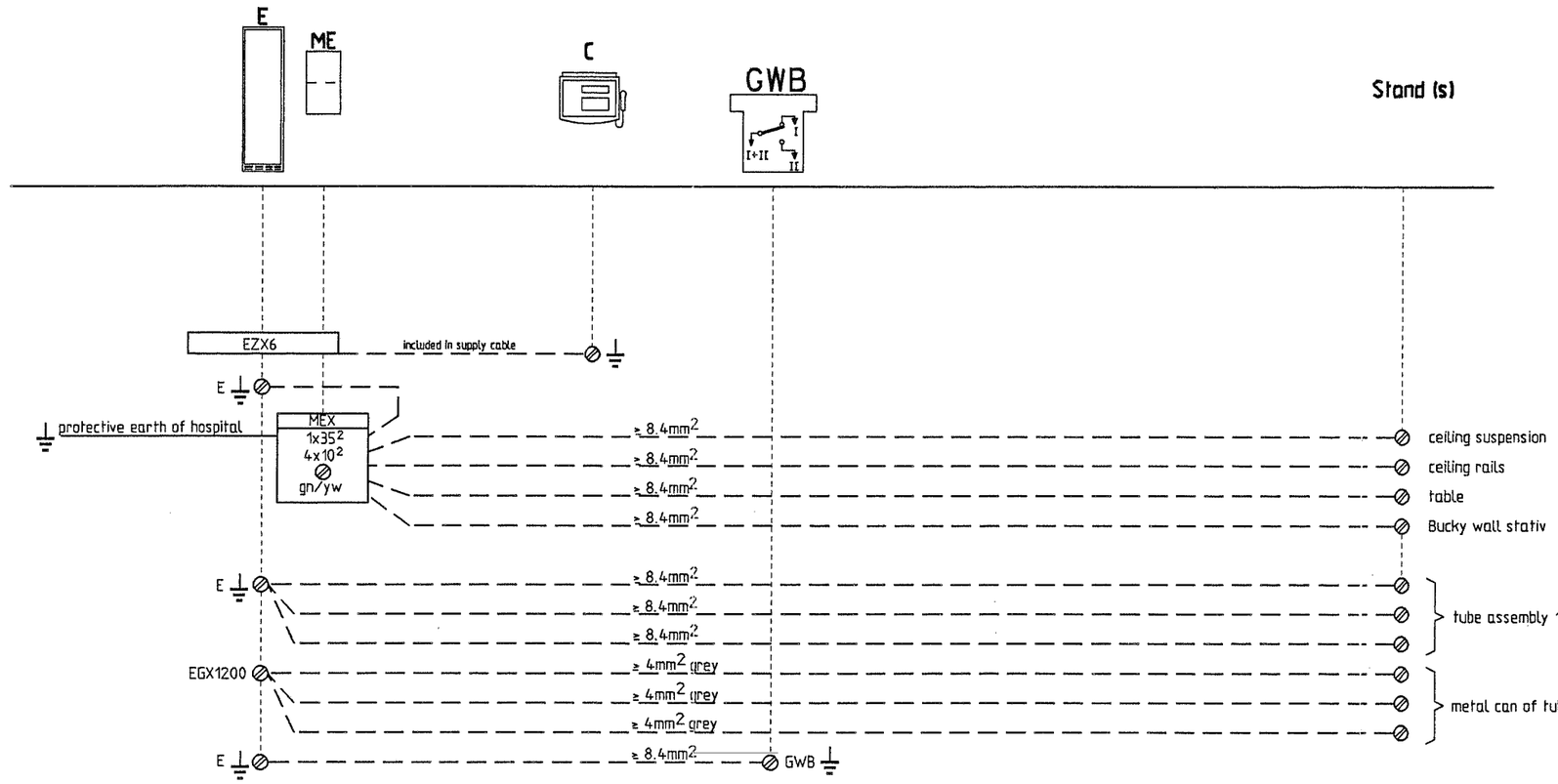

A2/A3 94-09-22 Schr.
u00616

Earthing diagram

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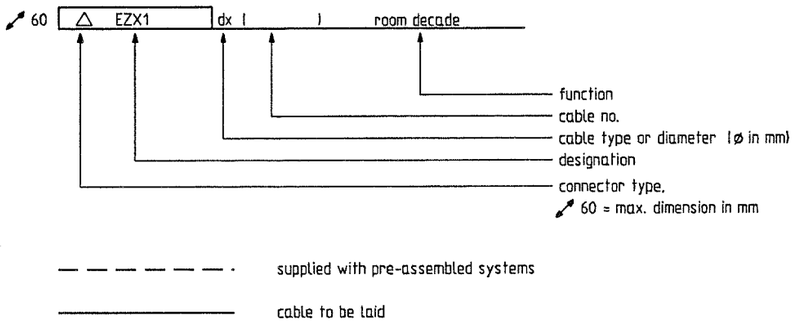
Symbols:

C operating desk
E X-ray generator cabinet
GWB H.V. changeover switch
ME wall junction box generator cabinet

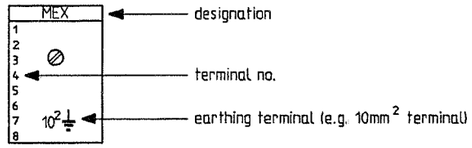
Cables:



Cable types:

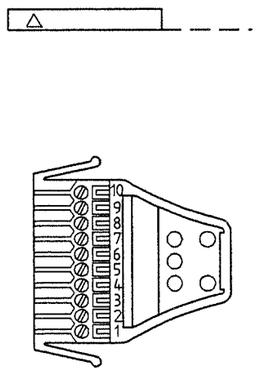
	Description	Data	
dx	10 x 0.5 mm^2	ø 9.0 mm	0722 276 05003
dy	2 x 0.5 mm^2	ø 6.3 mm	0722 215 01017
dz	10 x 0.5 mm^2	ø 9.7 mm	0722 215 19005
	3 x 1.31 mm^2 (AWG 16)	ø 9.2 mm	0722 215 02054
	1 x 8.4 mm^2	ø 7.6 mm	0722 186 00503
	1 x 4 mm^2, grey	ø 5.4 mm	0722 186 00124

Terminal blocks:



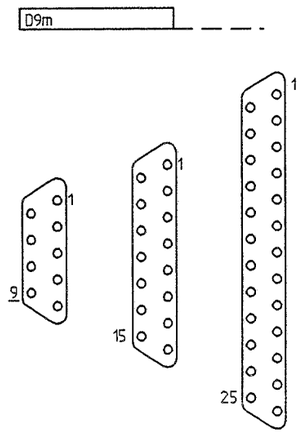
Connector types:

top decade connector (Wieland)



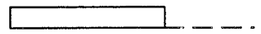
plug : 2422 025 04936
socket : 2422 013 00718

Sub-D connector



male female

Special connector



Legend

PRB-XRD products
A2/A3 94-09-22 Ost./Schr.
v00332

4512 982 00751 (94.0)
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INSTALLATION

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1. Installing the wall junction box

- Mount the wall junction box at the place where the generator is intended to be installed.
  (See drawing 1Z–3 and manual UNIT 4512 103 75380 for wall junction boxes).
- If applicable, mount the filler panels of the generator to the wall junction box.
- Have the mains cable present at the clinic connected to mains terminal MEX by a person who is authorized for this job.
- Check the phase sequence of L1, L2 and L3.
- Switch off the mains supply present at the clinic and make sure that it cannot be switched on again by anyone who is not authorized to do so.

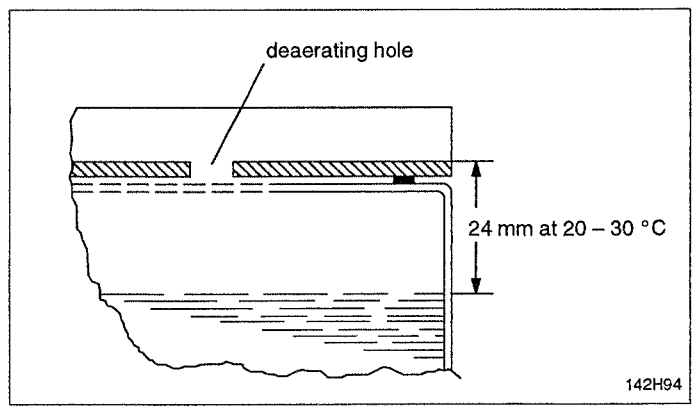
2. Mounting the H.V. generator in the cabinet

Caution!

Do not tilt the H.V. generator when transporting it!

In case a tilting angle of greater than 45° has been exceeded, the setting–to–work of the generator can be started not before a waiting time of about 8 hours has passed. Otherwise the H.V. generator may be destroyed by electrical sparkover!

- Unpack generator cabinet E.
- Unpack the H.V. generator.
- In case the packing material is strongly soiled with oil, check the oil level and, if necessary, correct.
  Watch that no foreign matter falls into the oil! Otherwise the transformer must be exchanged!
  Tolerance: ±2 mm
  Oil: Shell Diala G in 2.5 l container 4512 148 43172



- Take the two transport bars from the rear side of the cabinet.
- Lift the H.V. generator into the generator cabinet with the transport bars.
- Loosen the deaerating screw by turning it 3 times counter–clockwise.

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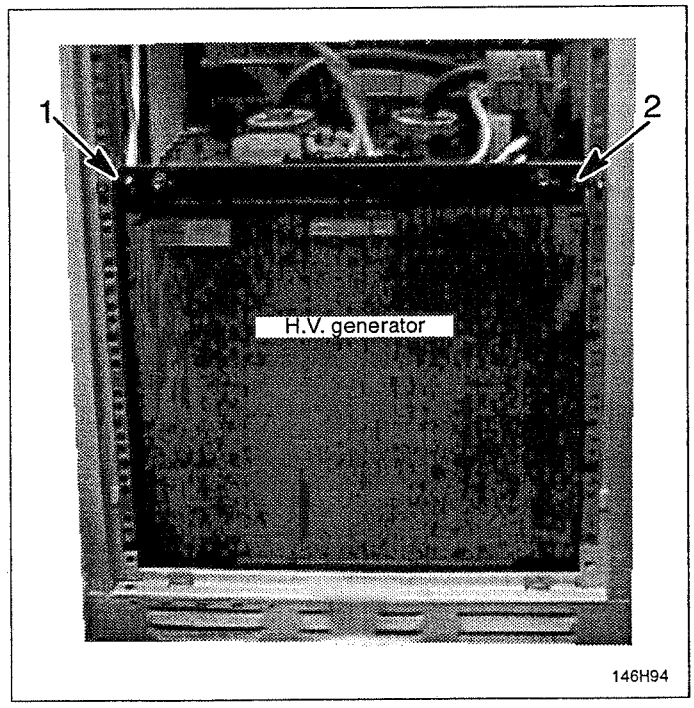
- Connect the H.V. generator electrically.

Always:	– E1 ⏚	——— GX1100 (ground)	
	– ZX12	——— G100X15	} Route the cables along the front and left–hand edge
	– ZX35	——— G100X14	} of the H.V. generator and fix them!
50 kW version:	– QC13:1	——— GX1003	} Twist the cables
	– QC 3:1	——— GX1002	}
	– GX1001	——— GX1003 (jumper)	
	– GX1002	——— GX1004 (jumper)	
≥ 65 kW version:	– QC13:1	——— GX1001	} Twist the cables
	– QC 3:1	——— GX1002	}
	– 2QC13:1	——— GX1003	} Twist the cables
	– 2QC 3:1	——— GX1004	}
2nd tube:	– WGX61	——— GK1:1	
	– WGX67	——— GK1:2	
	– WGX62	——— GK2:1	
	– WGX68	——— GK2:2	

- Fold the two earthing angles of the H.V. generator outward and screw it on to the members of the cabinet.



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3. Installing the operating panel

Note

The scope of delivery may include a second handswitch.

It can be connected to the desk by means of an adapter.

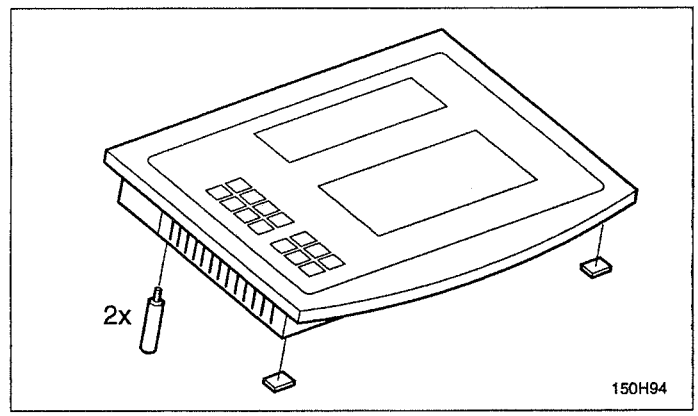
Two different wall hooks are supplied as a support for the handswitch.

3.1. Desk version

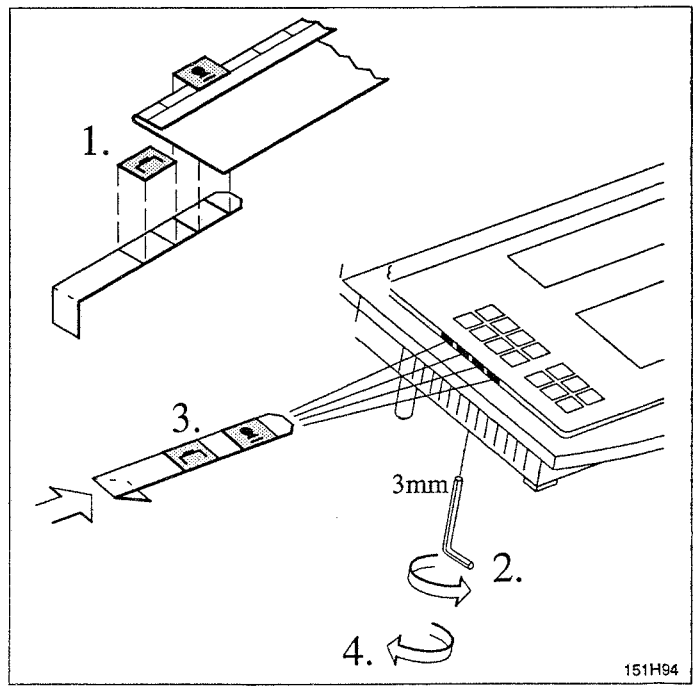
Accessories:

- 2 feet for the unit
- 2 elastic buffers, black
- 5 insert strips for the RGDV buttons
- sheet with RGDV symbols
- 1 doublesided adhesive tape
- handswitch
- support for handswitch
- mounting plate for support

- Carefully unpack the desk.
- Mount the support for the handswitch on the left–hand or right–hand side of the desk.
- Screw in the 2 feet for the unit at the bottom of the desk.
- Glue the 2 black elastic buffers to the front edges of the bottom of the desk such that they are acting as the front feet.
- Define the assignment of the RGDV buttons 1...8 and glue the respective symbols to the insert strips which are provided with subsidiary lines.



- Raise the keyboard from the bottom of the desk about 5 mm with an Allen key, 3 mm across flats.
- Push the insert strips under the keyboard foil. Press the angulated, protruding end of each insert strip into the housing of the desk.
- Lower the keyboard.
- Screw off the cable cover at the rear side of the desk..
- Connect the cables:
  - Supply cable EZX20 – C200X1
    EZX6 – earth
  - Data cable EZX46 – C300X1
  - Handswitch – C300X3
  - Printer – C300X2 (option)



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- Provide drag relief for the supply and data cables with the clamp present on the desk.
- Press the sleeve providing drag relief for the handswitch cable either into the left–hand or right–hand recess in the cable cover, depending on which side the handswitch support is mounted to.
- Screw on the cable cover.
- For USA:
  Fix the handswitch with the doublesided adhesive tape to the support.
  Fixing the handswitch will guarantee that radiography cannot be released somewhere away from the desk, for instance, in the examination room.

3.2. Stand version

See Z–5 "Operating panel".

Accessories:
- 4 dowels S10
- 4 hexagon cap screws 8 x 60 mm
- 4 washers

- Position the desk stand according to the respective room layout.
- Mark the fixing holes on the floor.
- Set the 4 dowels supplied into the floor (drill bit: 10 mm).
- Screw on the desk stand with 4 screws (13 mm across flats) and washers.
- Route the supply and data cables from the bottom to the top in the desk stand and provide the cables with drag relief. Cable ends including plugs should protrude beyond the edge of the desk by about 500 mm.
- Assign the RGDV buttons 1...8 with the desired symbols as described under 3.1.
- Connect the cables to the desk as described under 3.1.
- Screw on the cable cover.
- For USA:
  Fix the handswitch with the doublesided adhesive tape to the support.
  Fixing the handswitch will guarantee that radiography cannot be released somewhere away from the desk, for instance, in the examination room.
- Attach the operating panel on the stand.

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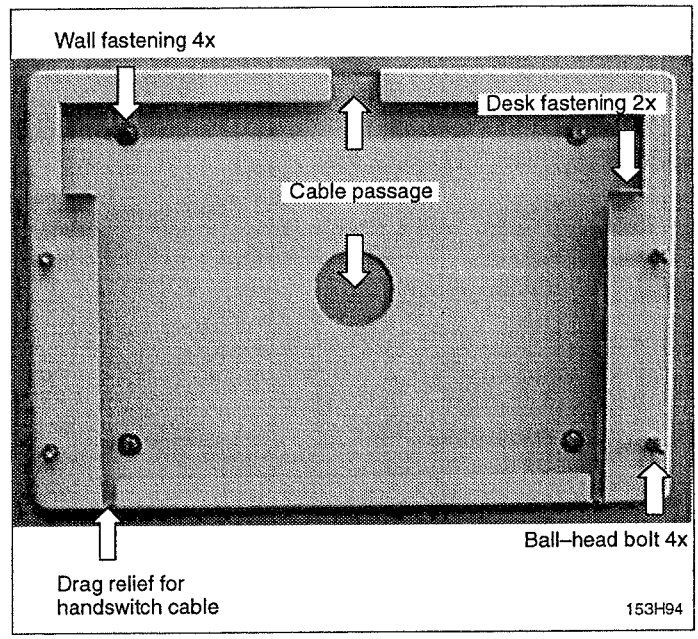
3.3. Wall mounted version

See Z–5 "Operating panel".

Accessories:

- 4 ball–head bolts
- 4 dowels S8
- 4 hexagon cap screws 5 x 30 mm
- 4 washers
- 2 screws 4 x 10 mm



- Screw the 4 ball–head bolts into the wall support.
- Mark the 4 fixing holes of the wall frame at the respective place on the wall.
- Set the dowels supplied into the wall (drill bit: 8 mm).
- Screw on the wall frame with 4 screws and washers.
- Provide drag relief for the supply and data cables in the wall frame. Cable ends including plugs should protrude beyond the edge of the desk by about 500 mm.
- A the RGDV buttons 1...8 with the desired symbols as described under 3.1.
- Connect the cables to the desk as described under 3.1.
- Press the sleeve providing drag relief for the handswitch cable either into the left–hand or right–hand recess in the cable cover, depending on which side the handswitch support is mounted to.
- Attach the operating panel on the wall frame and fix it with two screws.
- Screw on the cable cover.
- For USA:

  Fix the handswitch with the doublesided adhesive tape to the support.

  Fixing the handswitch will guarantee that radiography cannot be released somewhere away from the desk, for instance, in the examination room.

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4. Electrical connection

4.1. Earthing

See Z–7.4 "Earthing diagram".

4.2. Mains connection

See Z–7.4 "Connection diagram".

- Measure the internal mains resistance with a suitable measuring instrument.

  L1–L2: R_i= ..... mΩ

  L1–L3: R_i= ..... mΩ

  L2–L3: R_i= ..... mΩ

  Required max. mains resistance:

Mains voltage	30 kW	50 kW	65/80 kW
190 V *		40 mΩ	–
220 V *	130 mΩ	60 mΩ	–
240 V *	160 mΩ	80 mΩ	–
400 / 440 / 460 / 480 V	500 mΩ	300 / 350 / 350 / 400 mΩ	200 / 240 / 240 / 300 mΩ

* with external mains transformer

Maximum permissible internal mains resistance: 500 mΩ .

- Switch off the mains supply present at the clinic.
- Connect the mains cable (16 mm^2) of the generator to terminal MEX:L1/L2/L3 at the wall taking care that the phase sequence is correct.
- Connect the examination unit supply (max. 5 A) to terminal MEX:T1/T2/T3.

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4.3. Stator connection

At the generator end:

See Z–7.1/2 "Connection diagram".

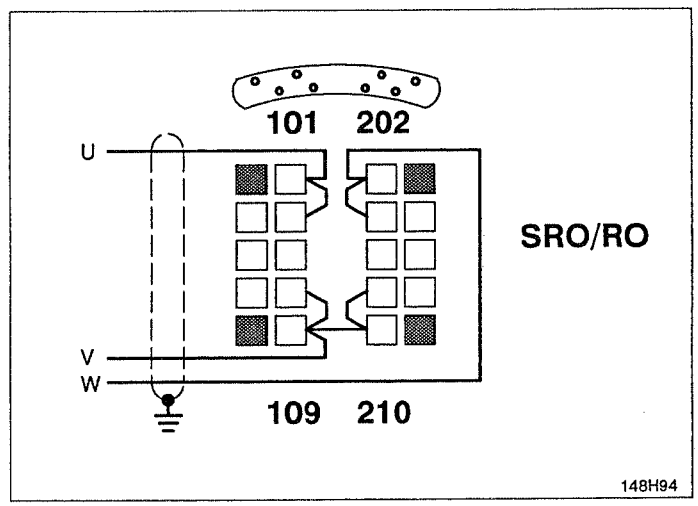
- Only with high–speed rotor control and 1–tube version:
  Route the stator cable inside the generator three times through the ring core supplied (2422 525 54113).
- Connect the stator cable to the rotor control or the stator contactors of the tube extension.
  Use wire 1 for phase U,
  wire 2 for phase V,
  wire 3 for phase W.
  Remove the screening plate to gain access to the connection at the high–speed rotor control.

Notes

– *Use screened cables. Connect the screen to earth at both ends.*

– *Do not mix up the phases, for otherwise components of the rotor control may be destroyed.*

At the tube end:



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4.4. Signal cables

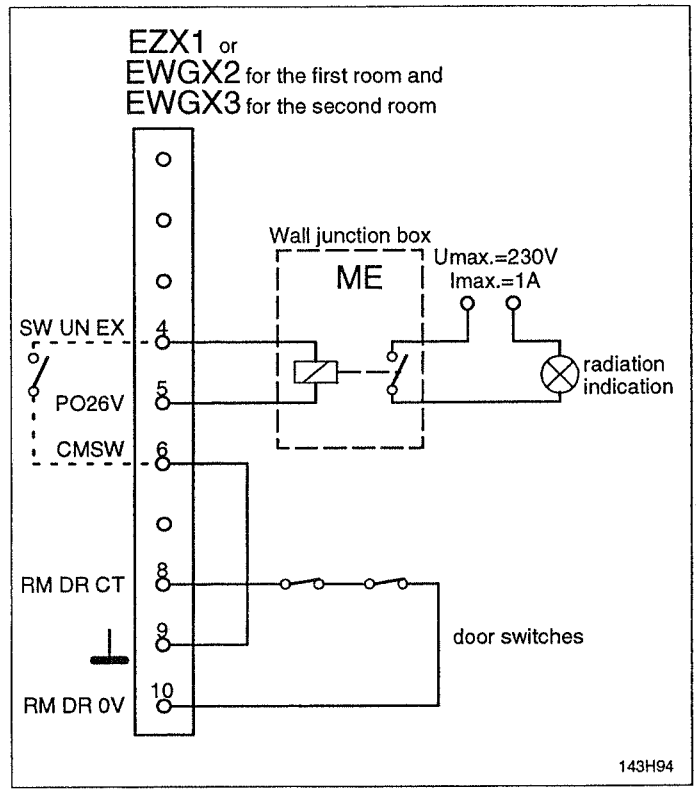
See Z–7.1/2/3 "Connection diagram".

4.4.1. Room decade cable

- In case of need connect the door switches at the generator.
- In case of need connect a external relay for each examination room to control external radiation warning devices.

  One relay inclusive cable is part of delivery.

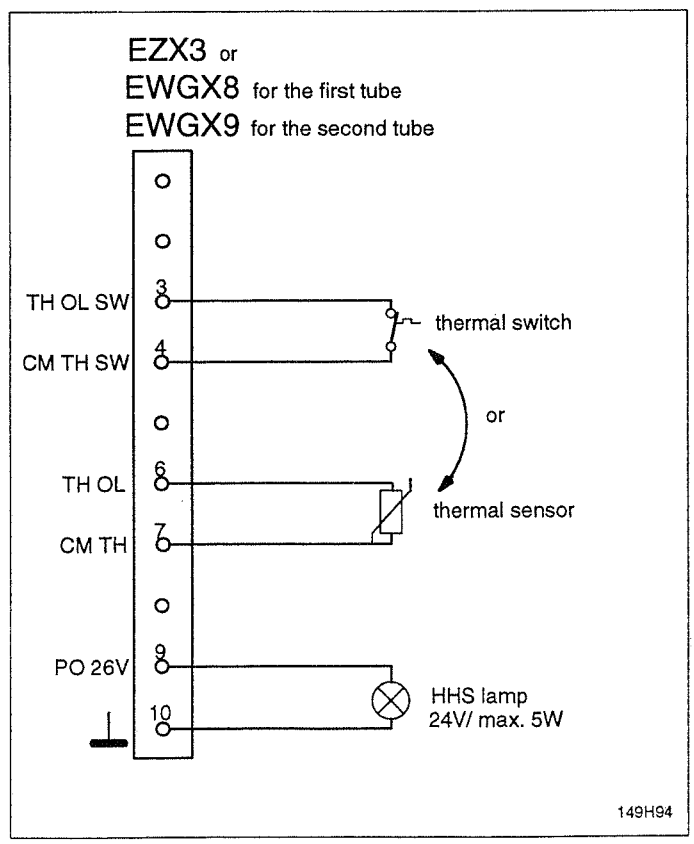
  A mounting place is reserved on the mains connection terminal MEX of the wall junction box.



4.4.2. Tube supervision

- Connect the thermal switch or the thermal sensor of the tube housing assembly.
- For U.S.A. only:

  Connect the so–called HHS–lamp to indicate the selected tube housing assembly.



4.4.3. CAN interface

For examination units which are provided with a CAN system interface.

- EZX 23 – signalbus
- EZX 43 – system CAN

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4.4.4. Adapter decade cable

For examination unit which provide their control signals separately via decade cables.

A maximum of 2 adapters for each of the 4 release circuits can be connected as a bucky/tomo interface.

Each of the release circuits can be assigned to one or several of the RGDV buttons 1...8 via software programming.

Survey: Z1–1.2 "Block diagram, expansions"

Detail: Z1–15.1 "Adapter 4 aux. units"

4.4.5. Measuring chamber

- Connect the ALC measuring chambers directly to the Sub–D connectors EZ21/22/31/32/41.
  (ALC = automatic leakage compensation)
- Connect the hybrid measuring chambers via one adapter AMPLIMAT cable 9890 000 02331 each.
  The generator is supplied with: 2 adapters for 1–tube version
  3 adapters for 2–tube version

Detail: Z1–6 "Basic interface"

4.5. H.V. cables

See Z–7.1/2 "Connection diagram".

- Mark the H.V. cables at the generator and the tube end with the correct polarity.
- Fix the H.V. cables on the left–hand side of the wall junction box on the middle rail for providing drag relief for the cables. The short ends of the H.V. cables which are going to the H.V. generator must be routed in downward direction in this area.
  The free cable lengths including plugs should be about 1.5 m.
- Twist the H.V. cables counter–clockwise by one turn and connect them to the H.V. generator.
  The twisting of the cables provides that the H.V. cables can be put into a loop when the cabinet is placed against the wall.
  The H.V. sockets should always be filled with some oil. At least the lower half of the plugs must be wet with oil.
  Do not fit a silicone washer.
  Do not rub them with silicone.

4.6. EMERGENCY–OFF circuit

- If applicable, connect the EMERGENCY–OFF buttons to EZX4:1/2.

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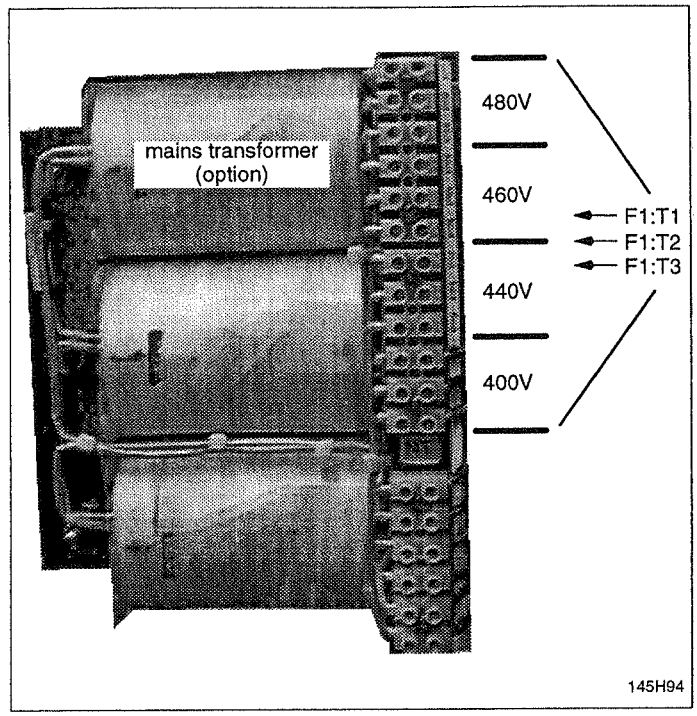
5. Hardware programming

- In case mains transformer 9890 000 02301 is present in the generator, connect the primary end according to the rated voltage of the mains.
- Place function programming plug "Desk" or "System" on EZX44 depending on whether a generator desk is connected or whether the generator control is effected via a system.



The rest of the generator hardware has been properly programmed at the factory.

If required, refer to section "Programming".

6. Switching on the generator

- Switch on the fuses present at the clinic.
- Switch on automatic circuit–breakers ENF1, ENF2 and ENF3.
  The yellow LED on EN100 POWER ON CIRCUIT must be illuminated.

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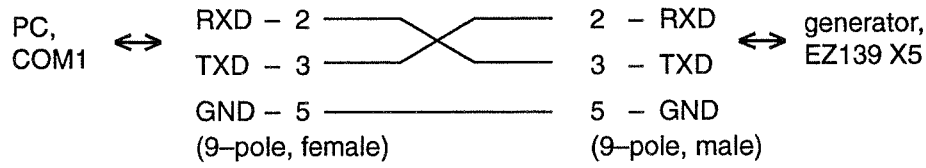
7. Using the installation software XRGSCOPE

- Provide the service PC with the hardware key and switch it on.
  The hardware key provides access to special program settings and to menu ***"Faultfind"***.
- Switch the generator on.
- Connect the PC to X5 on EZ139 CENTRAL UNIT CU via a serial data cable.



- Insert the installation disk in the PC.
- We recommend that the program be stored on hard disk (e.g. with DOS – command xcopy).
- Call the installation program with ***xrgscope*** or ***xrgscope lcd*** for PC's with LCD screen.
  The following menu line appears:

  File ***OPTIMUS*** ***Select Unit*** ***Options*** ***Help***

- Select "OPTIMUS".
  The following menu line appears:

  Program ***Adjust*** ***Accept*** ***Faultfind***

General information:

– Button F1	<help>	Call help/cancel help.
– Button F2	<transmit>	Store screen contents/data set in the generator ⇒ transmit to generator.
– Button F3	<save>	Store data set on disk; the path desired can be selected.
– Button F4	<cancel>	Cancel the command.
– Button Esc		Commands one step back; can be used repeatedly.
– Fields with ↓		Select the possible range of values with the RETURN button = ↵. The data are specified by the generator as fixed values.
– Fields with [...]		Input of data via the keyboard.

Error number 00L2 which appears at the beginning of the programming procedure must be erased from the screen with the RETURN button. The error number cannot be reset via the desk until a minimum exam./aux. unit and tube programming is complete. After a reset at the desk the error number reappears on the screen of the PC!
"Test" is displayed on the screen until the tube focus selected at the desk is adapted.

Note
Current data files, for instance, for online help, tube types, APR programming are available in BBS.
Product: Generatoren Hamburg
Download area: OPTIMUS

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8. Setting–to–work sequence

- Generator ON
- Program ... *Date and time*
  Mains data
  Tube
- Reset the generator *with ON button at the desk or S1 on PCB EZ139*
- Program ... *Dose Rate Control/ Chamber 1...5/ Data set 1...5*
- Reset the generator
- Program ... *Registration devices/ RGDV 1...8/ Data set A ... B*
  Registration devices/ RGDV interface assignment
- Reset the generator
- Conditioning the tube
- Adjust ... *Tube adaptation (all foci)*
- Reset the generator
- Adjust ... *Boost adaptation (all foci)*
- Reset the generator
- Program ... *Human interface/...* —> *All changes will be visible after a reset*
  ... /Select language
  ... /RGDV related assignment/ RGDV 1 ... 8/ Predefined assignment
- Reset the generator
- Density correction *Dose Rate Control/ Chamber 1...5/ Data set 1...5* – manual programming
- Accept... *Backup*

9. Configuration

9.1. Date and time

- Select menu "*Program/* ***Date and Time***".
- Enter the respective local data.

9.2. Mains data

- Select menu "*Program/* ***Mains Data***".
- Select the nominal value of the mains voltage U. Default: 400 V
- Enter the maximum internal mains resistance R_i. Range: 0...500 mΩ Default: 200 mΩ
- If needed for applicational reasons, reduce the generator output.

Depending on the internal mains resistance and the mains voltage the generator calculates the maximum possible output.

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9.3. Tubes

9.3.1. Tube data set

- Select menu "*Program/ Tubes/* ***Tube 1...3 Data Set***".
- Select the data set of the tube.
- Select the respective data file from the files listed up for each tube connected, e.g. "sro 2550.tdl".
- Reset the generator with the ON button at the desk or button S1 on PCB EZ139.
  Then the data which have been configured up to now are read by the processor when the system is started.

9.3.2. Tube limits

- Select menu "*Program/ Tubes/* ***Tube Limits***".
- Program the following parameters for each tube and focus:
  - Min./max. kV.
  - Min./max. mA.

The foci of all tubes are numbered consecutively:

– 1/9:	small focus	1st tube
– 2/9:	medium focus	1st tube
– 3/9:	large focus	1st tube
– 4/9:	small focus	2nd tube etc.

The values programmed are the limit values for applications. They are not effective during tube adaptation.

9.3.3. Capacitance of tube connection

- Select menu *"Program/ Tubes/* ***Capacitance tube connection***".
- The total capacitance for each tube connected is indicated.

C	=	$\frac{1}{2}$ ($C_{H.V.\ generator}$ + $C_{H.V.\ cable}$)	
$C_{H.V.\ generator}$	=	6.000 nF	
$C_{H.V.\ cable}$	=	C [pF/m] × L [m]	(= specified cable capacitance × simple cable length)
Default: C	=	4.550 nF	for H.V. generator + 20 m H.V. cable (155pF/m).

9.3.4. Disable tube

For correction of the configuration.

- Select menu "*Program/ Tubes/* ***Disable Tube***".

When the tube is switched off the above stored data set of the tube is erased. The tube limits programmed remain stored.

9.3.5. Tube speed selection

- Select menu *"Program/ Tubes/* ***Tube 1...3 speed selection***".
- Enter the required anode speed for bucky and fluoroscopy .

For RO–tubes :	bucky:	3000	fluoroscopy:	0
For SRO–tubes:	bucky:	9000	fluoroscopy:	0 or 3000

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9.3.6. Boost modes

- Select menu *"Program/ Tubes/* ***Boost modes****"*.

- Select ... Disable = Single boost. During preparation the rated filament current is applied (default).
  Enable = Double boost. During preparation a reduced filament current is applied.
  After the release of exposure boosting takes place for a short time before the exposure is released. Effective with currents > 80%.

9.4. Programming the film/screen combinations

5 film/screen combinations can be programmed for each of the 5 measuring chambers:

- Select menu *"Program/ Dose Rate Control/ Chamber 1...5/* ***Data Set 1...5****"*.
  The number of the chamber corresponds to the specified unit number of the dose measuring unit.

The choice between automatic and manual DRC processing is possible when an authorized hardware key is inserted in the PC.

Automatic is selected as default.

Automatic DRC processing:

- Select the desired data from the files offered for the following programming faults.
  The files are part of the installation software.
  - Select the programming field with the cursor and enter <Return>.
  - Enter the desired file from the list offered.
  - Select the desired data as required.

FILM	File "film.tdl":	Film types according to description of the manufacturer.
	File "film_bl/ _gr/ _uv.tdl":	General classification of the film according to color, sensitivity S and RLF compensation.
SCREEN	File "screen.tdl":	Screen types according to description of the manufacturer
		File "lumat_lg.tdl": Screen types according to luminous matter.
CHAMBER	File "chamber.tdl":	Different types of measuring chambers.
CASSETTE	File "cassette.tdl":	Different types of cassettes.
SYSTEM CORRECTION	File "syscor.tdl":	Select "Low kV–correction".

- Transmit the data with F2.
  Based on the combination of the components entered, the processor calculates the sensitivity of the system.
- Reset the generator.

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Manual DRC processing:

The current data set of the film/screen combination is displayed.

Abbreviation:	Abbreviation for the film/screen combination. Example: B400 = blue, intensification 400.
Dose Request Chamber:	Parameter of the measuring chamber type in [µGy/V].
Dose of FSC:	Switch–off dose of the film/screen combination in [µGy]. Linear ratio with respect to the film density.
kV70–Char. U_0...9:	Checkpoints for kV–dependent density correction.
kV70–Char. Drel_0...9:	Relative correction value for the dose.
RLF t_0...9:	Checkpoints for time–dependent density correction (RLF).
RLF Drel_0...9:	Relative correction value for the dose.

- If required, change the data.
  Usually no value except the basic density must be changed.
  To do so, change the switch–off dose in proportion with the desired film density.
- Transmit the data set with F2.
- Reset the generator.

Color and sensitivity class of the film/screen combination are displayed on the desk, for instance, G 400 (green, sensitivity class 400).
The other film/screen combinations (data set 1...5) for the chamber can be selected with the ± buttons.

9.5. Registration devices

- Select menu *"Program/ Registration devices/ RGDV 1...8/* ***Data Set A...B"***.
- Program the data set A and B of RGDV 1.....8 for all exam./aux. units desired.

Data set A:

Room:	Room number of the exam./aux. unit for data printout/room decade (radiation warning display and door contact).
Tube:	Tube assignment for the exam./aux. unit.
Mounted release circuit:	Assignment of the release unit for the exam./aux. unit (e.g.: FU ADAP A = WA/1WA or FU ADAP B = 2WA etc., also see Z1–1.2. none = free cassette.
Release circuit number:	Number of the release decade of the release unit programmed (e.g.: 1 for X1 etc., see Z1–1.2).
Enable handswitch at release circuit:	No = Operation/release via the handswitch at the desk. Yes = Release via release decade.
Syncmaster present:	E.g.: Bucky or tomo synchronous contact (20/21).
Exposure switch type:	Single step = Exposure request instantly with preparation (recommended for tube adaptation). Double step = Preparation request plus exposure request.

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Bucky format density correction:	Density correction in steps of 6%. Valid only when the assigned format contact is opened.		
Cone density correction:	Density correction in steps of 6%. Valid only when the assigned cone contact is opened.		
Dose measurement unit:	Unit 1...5	=	measuring chamber respectively at input EZX 21,22,31,32,41
	None	=	no measuring chamber assigned.
Multiple release during preparation:	Enable	=	More than one exposure possible with the same preparation. For tomo recommended.
	Disable	=	Instant braking after exposure.
Release delay:	Disable	=	e.g. free cassette.
	Enable,	=	For AEC techniques recommended.
Mounted tomo extension:	None	=	Definition of tomography time not possible via the examination unit.
	FU ADAP_A	=	WA/ 1WAX21 valid as tomography time input (option).
	FU ADAP_B	=	2WAX21 valid as tomography time input (option).
APR extension ...:	Yes/No	=	External selection of APR via X23 of the respective adapter. (being prepared)
PSC extension ...:	Yes/No	=	External patient–size correction via X24 of the respective adapter (being prepared).

Data Set B:

Used for tomography:	Yes/No With "Yes" a definition of the tomography time is expected from the examination unit, e.g. via WAX21. (Option)		
Disable time input from console:	Yes/No		
Tube power usage:	1 ... 100%		
U step rate:	Single–step series	=	kV–grading in steps of 1 kV.
	Dose equivalent series	=	kV–grading corresponding to 20% density change.
Q step rate:	R10/ R20/ R40	=	mAs step width in 25, 12 or 6%.
I step rate:	R10/ R20/ R40	=	mA step width in 25, 12 or 6%.
t step rate:	R10/ R20/ R40	=	step width in 25, 12 or 6%.
Density step rate:	R10/ R20/ R40	=	density steps in 25, 12 or 6%.
Density correction:	–8 ... +8	=	correction in steps of 6% .
Underexposure display with manual techniques:	Yes	=	Underexposure is also indicated with techniques without AMPLIMAT.
	No	=	e.g. tomo

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- Select menu *"Program/ Registration devices/ RGDV Interface assignment/* ***Device interface 1...2***".
  Device interface 1 = adapter decade cable WA or 1WA (FU Adap_a)
  Device interface 2 = adapter decade cable 2WA (FU Adap_b)
- Assign the format and ready contacts to a bucky or tomography RGDV.
  - Decade Bucky 1 (X11)

    Tomo mode switch: Disable = Input "tomo mode" is activated. Changeover Bucky/tomography not possible via the examination unit.
    Enable = Input "tomo mode" is activated. Remote changeover Bucky/tomography possible. Bucky and tomo RGDV must be defined.

    Bucky RGDV: None/ RGDV 1...8
    The inputs "format contacts" and "bucky ready" are activated.
    When the tomo mode switch is enabled, this RGDV is activated when the tomo mode switch is open.

    Tomo RGDV: None/ RGDV 1...8
    The inputs "format contacts" and "tomo ready" are activated.
    When the tomo mode switch is enabled, this RGDV is activated when the tomo mode switch is closed.
  - Decade Bucky 2 (X12) Program the functions as for the first Bucky decade.
  - Tomo Time 0.1 ... 6000 ms for each trajectory.
    All of the 8 must be programmed even when they are not used.

One tomography unit can be programmed for each device interface.

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10. Tube adjustment

Warning!
Radiation is released during the adjustment procedure!

The generator must be in the READY state, i.e. the green ring at the desk must be illuminated!

10.1. Tube conditioning

In case the X–ray tube has been out of operation for >6 months:

- Carry out the complete manual or automatic conditioning procedure.

In case the X–ray tube has been out of operation for 14 days ... 6 months:

- Release 20 exposures below 110 kV with maximum current.

60 kV 4 x $I_{max.}$
81 kV 4 x $I_{max.}$
90 kV 4 x $I_{max.}$
102 kV 4 x $I_{max.}$
109 kV 4 x $I_{max.}$

10.1.1. Manual mode

Example RO 17 50:

Conditioning is possible only if at the first position under RGDV 1 an APR is loaded which is programmed for mAs–technique.

If necessary, load and reprogram an APR according to 11.3.3 and 11.4.

In the event of electrical irregularities reduce the voltage by 10 kV and initiate a few switching actions, afterwards proceed with the program.

If trouble continues to occur at voltages > 110 kV, start from 80 kV again.

- Select a registration device for tube 1 on the operating desk.

- Release one exposure of each kV stage. Give 20 s pause between the exposures.

Large focus:

60 kV	700 mAs
81 kV	640 mAs
90 kV	560 mAs
102 kV	500 mAs
109 kV	470 mAs
117 kV	440 mAs
125 kV	400 mAs

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- Release one exposure of each kV stage.

Large focus:

kV max.	=	125 kV	kV max.	=	150 kV
81 kV		64 mAs	81 kV		62 mAs
90 kV		56 mAs	102 kV		50 mAs
102 kV		50 mAs	109 kV		47 mAs
109 kV		47 mAs	117 kV		44 mAs
117 kV		44 mAs	125 kV		40 mAs
125 kV		40 mAs	133 kV		38 mAs
			141 kV		36 mAs
			150 kV		33 mAs

- Select the small focus.
- Release two exposures of each kV stage.

Small focus:

kV max.	=	125 kV	kV max.	=	150 kV
81 kV		21 mAs	81 kV		21 mAs
90 kV		19 mAs	102 kV		17 mAs
102 kV		17 mAs	109 kV		16 mAs
109 kV		16 mAs	117 kV		15 mAs
117 kV		15 mAs	125 kV		14 mAs
125 kV		14 mAs	133 kV		13 mAs
			141 kV		12 mAs
			150 kV		11 mAs

- Proceed equally for tubes 2 and 3.

10.1.2. Automatic mode (being prepared)

- Select a registration device for tube 1 on the operating desk.
- Start the conditioning procedure for the tube selected in menu *"Adjust/* ***Tube Conditioning****".*
- Proceed equally for tubes 2 and 3.

10.2. Adaptation of the tube

In case an error message occurs during the adaptation procedure, reset the generator and repeat the adaptation for this particular focus.

Recommendation: Program the handswitch to "single step".

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10.2.1. Tube adaptation

- Select menu *"Adjust/* ***Tube Adaptation****"*.
- Select the tube to be adapted and the focus to be adapted.
  Start with the small focus!
- Press button F2.
  - "Adap" is displayed on the desk.
  - "Waiting" is displayed on the screen.
- Wait until the generator is in the READY state.
- Start the adaptation procedure by pressing the handswitch continuously.
  The generator carries out adaptation of the focus automatically.
  The tube adaptation of the focus is complete when "Adap" has disappeared on the desk and "Test" is displayed.
- Let go of the handswitch.
- Reset the generator.
- Repeat the adaptation procedure for each additional focus and tube.

10.2.2. Boost adaptation

- Select menu "Adjust/ **Boost Adaptation**".
- Select the tube to be adapted and the focus to be adapted.
  Start with the small focus!
- Press button F2.
  - "Adap" is displayed on the desk.
  - "Waiting" is displayed on the screen.
- Wait until the generator is in the READY state.
- Start the boost adaptation by pressing the handswitch continuously.
  The generator carries out adaptation of the focus automatically.
  The tube adaptation of the focus is complete when "Adap" has disappeared on the desk and a standard data set is displayed on condition that the respective focus has been selected at the desk.
- Let go of the handswitch.
- Reset the generator.
- Repeat the adaptation procedure for each additional focus and tube.

11. Programming the operating desk

A maximum of up to 1024 APR's can be stored in the generator.

The initial data sets are called ### APR name ### and they have the same exposure parameters.

They can be directly assigned or via menu and submenu levels to registration devices RGDV 1...8.

In case "Test APR" is displayed after selection of a registration device, at least this particular registration device has not been assigned to any APR's.

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11.1. Language

The language for operating instructions and error messages is selected in this menu.

- Select menu "*Program/ Human Interface/* ***Select Language***".
- Select the desired language:
  - English = GB
  - German = D
  - French = F
  - Spanish = E

11.2. Automatic programming of APR's

The installation disk contains data files for a complete, typical APR programming in different languages.

Standard APR programs for each application can easily and quickly be loaded for each registration device.

- Select menu *"Program/ Human interface/ RGDV related assignment/ RGDV 1...8/* ***Predefined assignment***".
- Select one of the files listed up, e.g. "apra4eng.tdl".

  Meaning: ap = APR data file
  r = radiography
  a4 = version
  p = pediatrics
  eng = language; eng = English, deu = German, swe = Swedish, ned = Dutch, esp = Spanish, fra = French
- Select one of the applications listed up, e.g. "Bucky", and load the data file.

  Extension GR = Group; APR's are divided into groups (menu technique),
  Extension PA = Paging; APR's are assigned directly to an application.
- Repeat this procedure for each registration device.
- Reset the generator.

  Now all APR programs which have been loaded are displayed on the desk.

If required:

- Change the name and the contents of the APR's according to 11.4.
- Change the menus and the assignment of the APR's according to 11.3.

Note

In case a complete APR program setting is to be replaced by another program setting, all other APR program settings under the registration device concerned must be deleted first.

For deleting a program setting call menu "Program/Human interface/RGDV related assignment/RGDV 1...8/Manual assignment/ ***Delete menu*** *" and select the blank line.*

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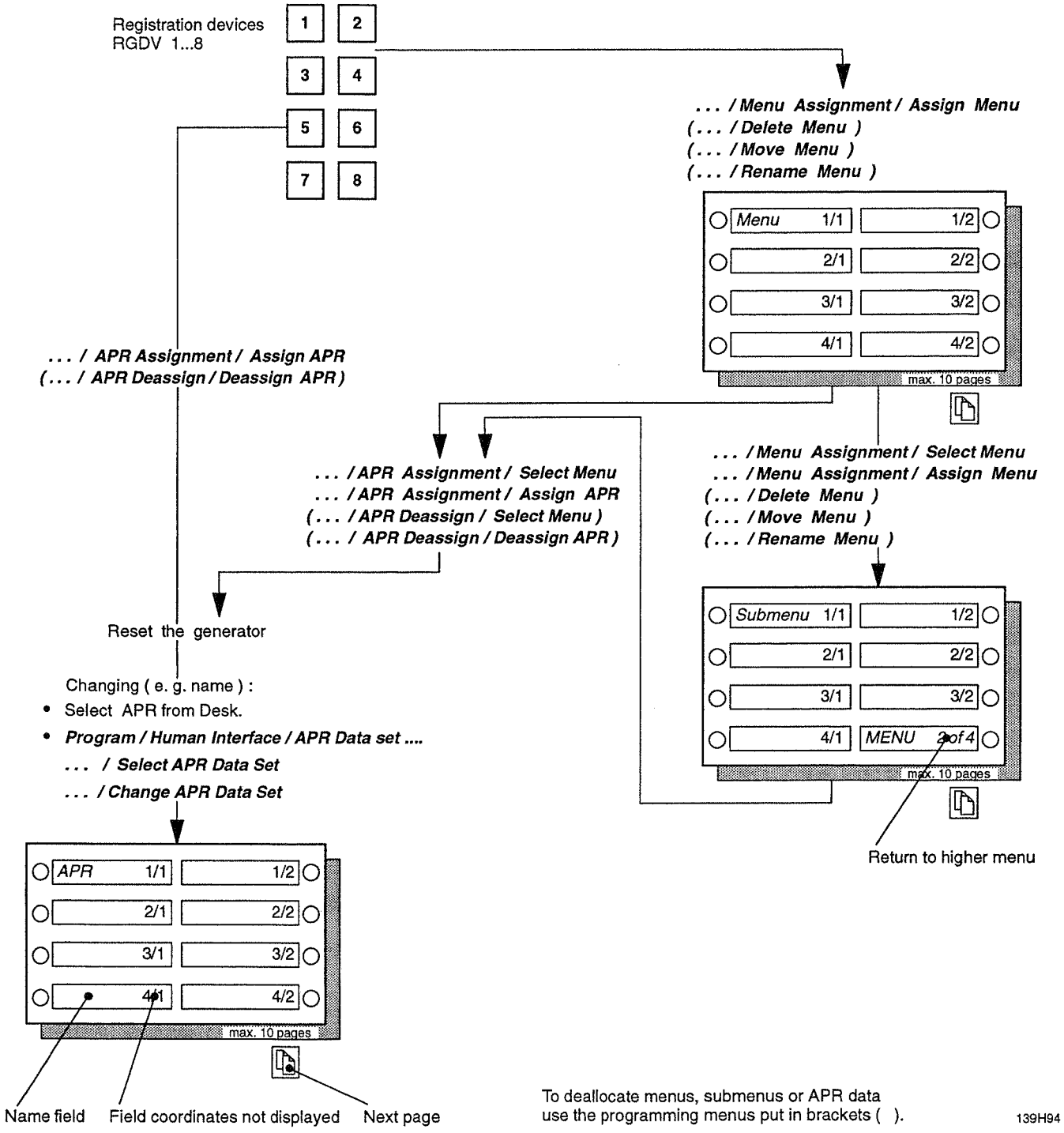
11.3. Manual programming of APR's

Manual APR and menu assignment possibilities

- Select service menu ***Program/ Human Interface/ RGDV Related Assignment/ RGDV 1...8 /Manual Assignment ...***



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11.3.1. Creating menus

- Select menu *"Program/ Human interface/ RGDV related assignment/ RGDV 1...8/ Manual assignment/ Menu assignment/* ***Assign menu***".
- Enter the first menu name, e.g. "Body region 1".
- If required, change the location suggested in the display. Otherwise the next vacant location is assigned.
- Enter the second menu name, e.g. "Body region 2".

Etc.

11.3.2. Creating sub menus

- Select menu *"Program/ Human interface/ RGDV related assignment/ RGDV 1...8/ Manual assignment/ Menu assignment/* ***Select menu***".
- Select with the cursor from one of the windows a menu to be assigned with submenus.
- Select menu *"Program/ Human interface/ RGDV related assignment/ RGDV 1...8/ Manual assignment/ Menu assignment/* ***Assign menu***".
- Enter the first submenu name, e.g. "Left side".
- If required, change the location suggested in the display. Otherwise the next vacant location is assigned.
- Enter the second submenu name, e.g. "Right side".

Etc.

11.3.3. Creating or assigning APR's

- Select menu *"Program/ Human interface/ RGDV related assignment/ RGDV 1...8/ Manual assignment/ APR assignment/* ***Select menu***".
- Select with the cursor from one of the windows a menu or submenu.
- Select menu *"Program/ Human interface/ RGDV related assignment/ RGDV 1...8/ Manual assignment/ APR assignment/* ***Assign APR***".
- Select from one of the windows an initial APR or an APR which has not been assigned.
  Initial APR: "### APR name ###
  Not assigned APR: e.g. "Thorax ap"
- If required, change the location suggested in the display. Otherwise the next vacant location is assigned.
- Assign the next APR.

Etc.

- Reset the generator.

Only after a reset of the generator the menus, submenus and APR's are displayed on the desk.

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11.4. Changing of APR's

- Select the APR to be changed on the desk, e.g. ### APR name ###.
- Select menu *"Program/ Human interface/ APR data set/* ***Select APR data set***".
  The number of the APR selected on the desk is displayed.
- Select menu *"Program/ Human interface/ APR data set/* ***Change APR data set***".
- Change the contents of the APR, e.g. name, kV etc.
- Select the next APR on the desk, select it in the programming menu and change it.

Etc.

- Reset the generator.

The customer can overwrite and store the exposure parameters of an APR without having to use a PC.

Refer to the operator' manual.

11.5. Moving/copying of an APR data set

Determination of the number of APR data set "x" to where APR data set "y" is to be moved/copied.

- Select APR data set "x" on the desk.
- Select menu *"Program/ Human Interface/ APR Data Set/* ***Select APR Data Set***".
- Note the number of APR data set "x", for instance, 100.

Changing of the number of APR data set "y" to be moved/copied to the number of APR data set "x"

- Select APR data set "y" on the desk.
- Select menu *"Program/ Human Interface/ APR Data Set/* ***Select APR Data Set***".
  Transmit with F2.
- Select menu "*Program/ Human Interface/ APR Data Set/* ***Change APR Data Set***".
- Replace the number of APR data set "y" with the number of APR data set "x" in the input mask, for instance, nnn ⇒ 100.
- Transmit this number with F2 and reset the generator.

APR data set "y" is displayed in place of the old APR data set "x" on the desk.
In case APR data set "y" is merely moved and not copied to the location of APR data set "x", the original APR data set "y" must be deleted at the end of programming.

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11.6. Deleting of APR's

- Select menu *"Program/ Human interface/ RGDV related assignment/ RGDV 1...8/ Manual assignment/ APR deassign/* ***Select menu***".

  Required only when the APR is assigned to a menu or submenu.

- Select the associated menu or submenu from one of the windows.

- Select menu *"Program/ Human interface/ RGDV related assignment/ RGDV 1...8/ Manual assignment/ APR deassign/* ***Deassign APR***".

- Select the APR to be deleted from one of the windows.

- Reset the generator.

An APR which has been deleted is no longer displayed on the desk but remains stored in the generator. It can be re–activated according to 11.3.3.

11.7. Manipulating menus

Deleting:

- Select menu *"Program/ Human interface/ RGDV related assignment/ RGDV 1...8/ Manual assignment/ Menu assignment/* ***Delete menu***".

- Select the menu or submenu to be deleted from one of the windows.

- Reset the generator.

Shifting:

- Select menu *"Program/ Human interface/ RGDV related assignment/ RGDV 1...8/ Manual assignment/ Menu assignment/* ***Move menu***".

- Select the menu or submenu from one of the windows.

- Enter the new positions.

- Reset the generator.

Re–naming:

- Select menu *"Program/ Human interface/ RGDV related assignment/ RGDV 1...8/ Manual assignment/ Menu assignment/* ***Rename menu***".

- Select the menu or submenu from one of the windows.

- Enter the name in the lowermost line.

- Reset the generator.

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12. Density correction

AMPLIMAT technique:

A hardware key is required at the PC.

- Select menu *"Program/ Dose rate control/ Chamber 1...5 / **Data set 1...5**"*.
- Select manual DRC programming with <Escape>.
- Correct the switch–off dose FSC according to formular below:

$$\text{New switch–off dose} = \frac{\text{Desired density}}{\text{Measured density}} * \text{Old switch–off dose}$$

- Transmit the data set with F2.
- Reset the generator.

Correction for each RGDV 1...8:

- Select menu *"Program/ RGDV 1...8/ **Data set B**"*.
- Density correction: –8 ... +8 = correction in steps of 6%.

Organ–dependent correction:

- Select the APR to be changed on the desk.
- Select menu *"Program/ Human interface/ APR data set/ **Select APR data set**"*.
  Confirm the APR number displayed with <Transmit>.
- Select menu *"Program/ Human interface/ APR data set/ **Change APR data set**"*.
- Exposure data density: –8 ... +8 = correction in steps of 6%.
- Select the next APR on the desk, select it in the programming menu and change it.

Etc.

- Reset the generator.

13. Labels

- Check the labelling according to the respective generator type.

See drawing 2Z–1.

The data labels of the generator are arranged on an information carrier which is located on the left–hand side of the upper edge of the cabinet. This information carrier is labelled "i".

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14. Executing the acceptance test

- Execute the acceptance test according to section *"Acceptance"*.
- Observe all applicable national regulations.

For USA:

Checking H.H.S. requirements

After completition of setting–to–work, the system must be tested for H.H.S. compliance according the P.M.S.I. comprehensive compliance testing workbook (Code No. 4535 800 2035.).

15. Saving all configuration data

- Store the configuration data on floppy disk "Generator configuration data" supplied in menu *"Accept/* ***Backup****"*.
  At the moment a backup is only possible for the APR programs of registration devices RGDV 1...8.
- Provide the floppy disk with the serial number of the generator.
- Keep the floppy disk in the service documentation.

16. Final installation work

- Mount the side panels of the generator cabinet.
- Roll the generator cabinet against the wall.
  Take care that all cables inside the wall junction box are routed in a loop without any kinks.
- Block the two front wheels of the cabinet with the locking screws to guarantee that unauthorized persons cannot accidentally touch parts of the generator which might be dangerous.
- If necessary, level the cabinet with the locking screws.
- Mount the front cover of the generator.

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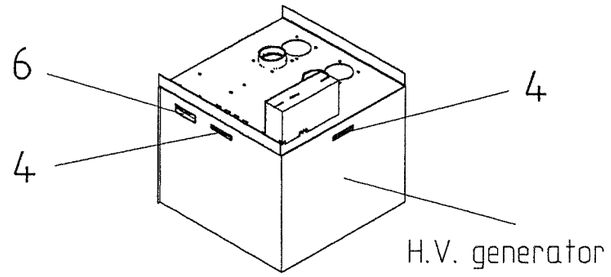

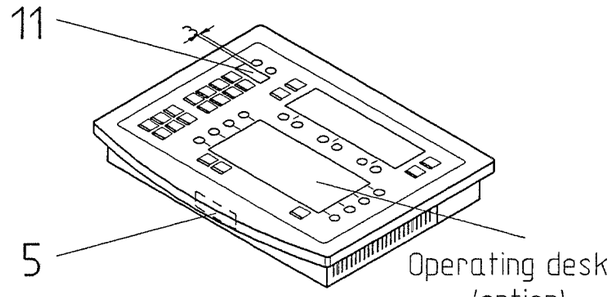

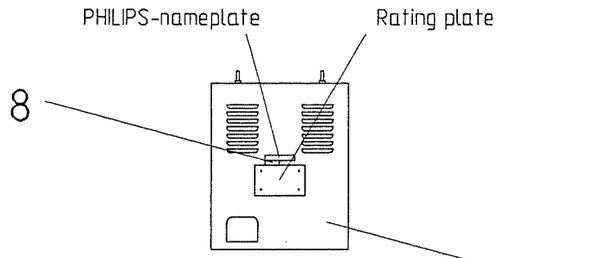

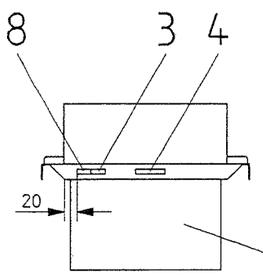

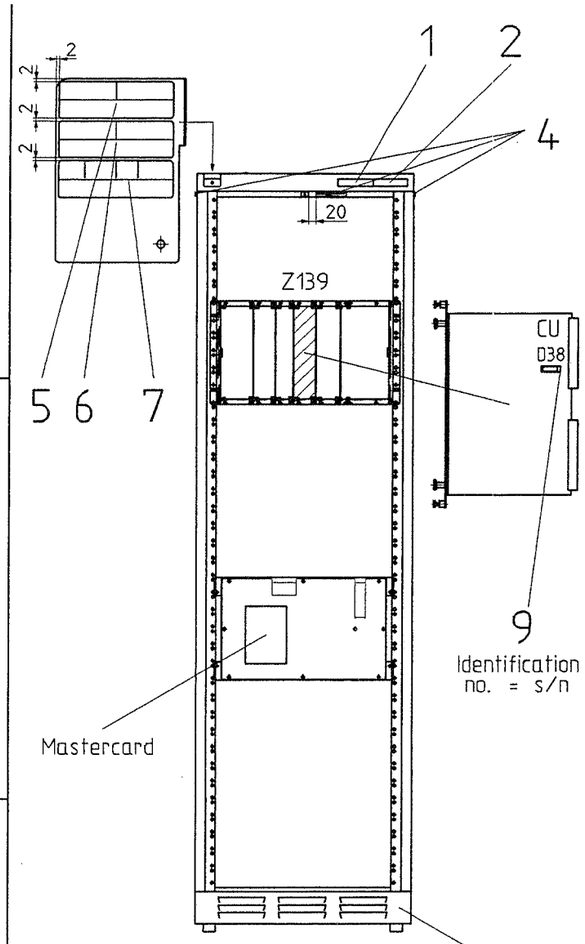

1 **OPTIMUS 50**

1 **OPTIMUS 65**

1 **OPTIMUS 80**

1 **OPTIMUS 100**

2 PHILIPS
MADE IN GERMANY

3
Philips Medizin Systeme
Röntgenstrasse 24
22335 Hamburg
Germany

4 CAUTION
HAZARD FOR LIVE AND/OR MOVING PARTS.
ATTENTION WHEN SERVICING ENERGIZED EQUIPMENT.
OBSERVE THE SERVICE-MANUAL.

5

-X-RAY CONTROL-	Philips Medizin Systeme
type 9890 000 0200x	Röntgenstrasse 24
s/n xx xxxx	22335 Hamburg
OPTIMUS xxx	Germany

6

-X-RAY HV GENERATOR-	Philips Medizin Systeme
type 9890 000 0200x	Röntgenstrasse 24
s/n xx xxxx	22335 Hamburg
OPTIMUS xxx	Germany

7 50 KW

	3~50/60 HZ		
	400V	5A	145 A
	480V	4A	120 A

7 65 KW

	3~50/60 HZ		
	400V	5A	190A
	480V	4A	160A

7 80 KW

	3~50/60 HZ		
	400V	5A	230A
	480V	4A	190A

7 100 KW

	3~50/60 HZ		
	400V	5A	260A
	480V	4A	220A

8
type Produktname
s/n Fabr. Nr.
code Code Nr.

9 SN.

Regulation- dependant labels

5

-X-RAY CONTROL-	Philips Medizin Systeme
type Produktname	Röntgenstrasse 24
s/n Fabr. Nr.	22335 Hamburg
code CI-Nr. oder PEI-Nr.	Germany

CERTIFICATION This product complies with the Performance Standard under the Radiation Control for Health and Safety Act of 1968, applicable at date of manufacture. Manufactured: MONAT JAHR — HHS

6

-X-RAY HV GENERATOR-	Philips Medizin Systeme
type Produktname	Röntgenstrasse 24
s/n Fabr. Nr.	22335 Hamburg
code CI-Nr. oder PEI-Nr.	Germany

CERTIFICATION This product complies with the Performance Standard under the Radiation Control for Health and Safety Act of 1968, applicable at date of manufacture. Manufactured: MONAT JAHR — HHS

7 50 KW

	3~50/60 HZ		
	400V	5A	145 A
	480V	4A	120 A

- X-RAY EQUIPMENT -
CLASSIFIED BY UNDERWRITERS LABORATORIES INC WITH RESPECT TO ELECTRICAL FIRE, SHOCK AND MECHANICAL HAZARDS ONLY 641B — LR 37323 C — UL CSA

7 65 KW

	3~50/60 HZ		
	400V	5A	190A
	480V	4A	160A

- X-RAY EQUIPMENT -
CLASSIFIED BY UNDERWRITERS LABORATORIES INC WITH RESPECT TO ELECTRICAL FIRE, SHOCK AND MECHANICAL HAZARDS ONLY 641B — LR 37323 C — UL CSA

7 80 KW

	3~50/60 HZ		
	400V	5A	230A
	480V	4A	190A

- X-RAY EQUIPMENT -
CLASSIFIED BY UNDERWRITERS LABORATORIES INC WITH RESPECT TO ELECTRICAL FIRE, SHOCK AND MECHANICAL HAZARDS ONLY 641B — LR 37323 C — UL CSA

7 100 KW

	3~50/60 HZ		
	400V	5A	260A
	480V	4A	220A

- X-RAY EQUIPMENT -
CLASSIFIED BY UNDERWRITERS LABORATORIES INC WITH RESPECT TO ELECTRICAL FIRE, SHOCK AND MECHANICAL HAZARDS ONLY 641B — LR 37323 C — UL CSA

11 **WARNING:**
THIS X-RAY UNIT MAY BE DANGEROUS TO PATIENT AND OPERATOR UNLESS SAFE EXPOSURE FACTORS AND OPERATING INSTRUCTIONS ARE OBSERVED. — HHS

OPTIMUS
A3/A3 94-10-13 Ost.
v00328

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FAULT FINDING

TEXT

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DRAWINGS

Central rack, service aid	3Z–1

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1. Tools

- Service engineer mechanical tool kit
- mAs meter
- Multimeter
- Digital oscilloscope with 2–beam memory
- PC incl. 3.5" FDD, HW–dongle, serial interface cable
- Service software "XRG SCOPE" 4512 152 04751

2. Notes

Caution!
After the generator has been switched off, hazardous voltages are still applied to the d.c. intermediate circuits of the converter and the rotor control.

These voltages are usually discharged within 1 minute to values which are no longer dangerous.

3. Strategy

There are 3 categories of errors:

- The generator cannot be switched on at all or only for a short time.

  See ⇒ 5. "Initialization phase of the generator"
  ⇒ 6. "Switch–on not possible"

- The generator can be switched on but no error numbers are displayed on the operating desk.

  For fault finding use the service PC.

  See ⇒ 4. "Connecting the service PC"
  ⇒ 5. "Initialization phase of the generator"
  ⇒ 7. "Error numbers"

- Error messages are displayed on the desk.

  For fault finding use the service PC.

  See ⇒ 4. "Connecting the service PC"
  ⇒ 7. "Error numbers"

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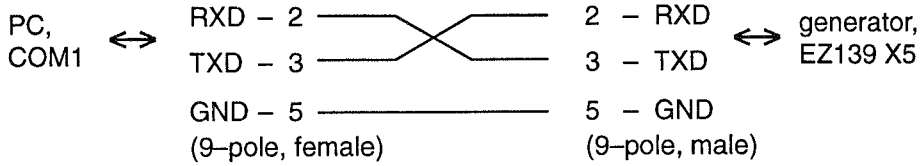
4. Service–PC

4.1. Connection

- Switch the generator on.
- Provide the PC with the HW key and switch it on.
- Connect the PC to X5 on EZ139 CENTRAL UNIT CU via a serial data cable.



4.2. Operation

- Insert the floppy disk with the service program in the PC.
- Call the program with ***xrg scope***.
- Enter you password
  The following menu line appears:

FILE FU–CU SELECT UNIT OPTIONS HELP

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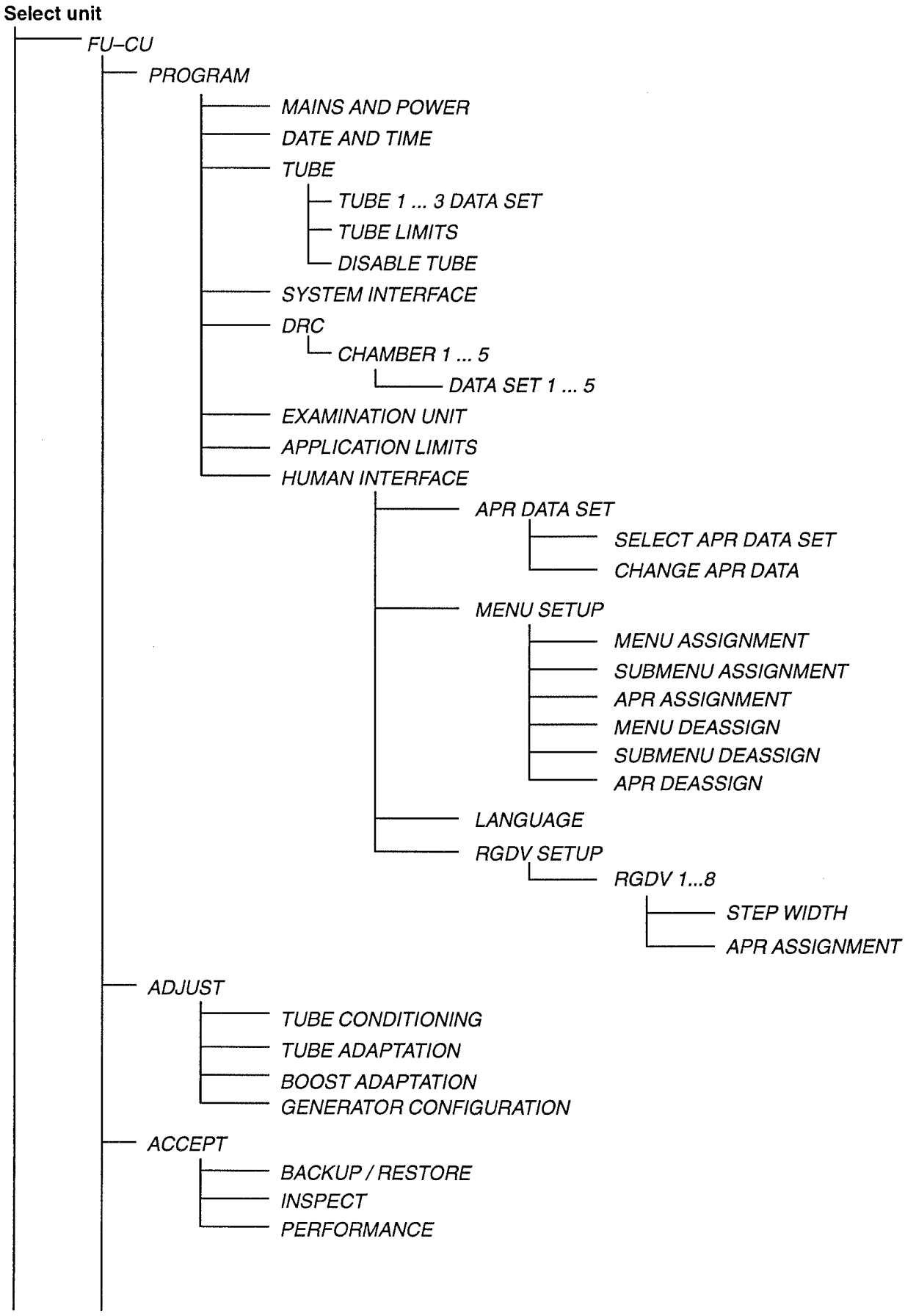
4.3. Menu structure



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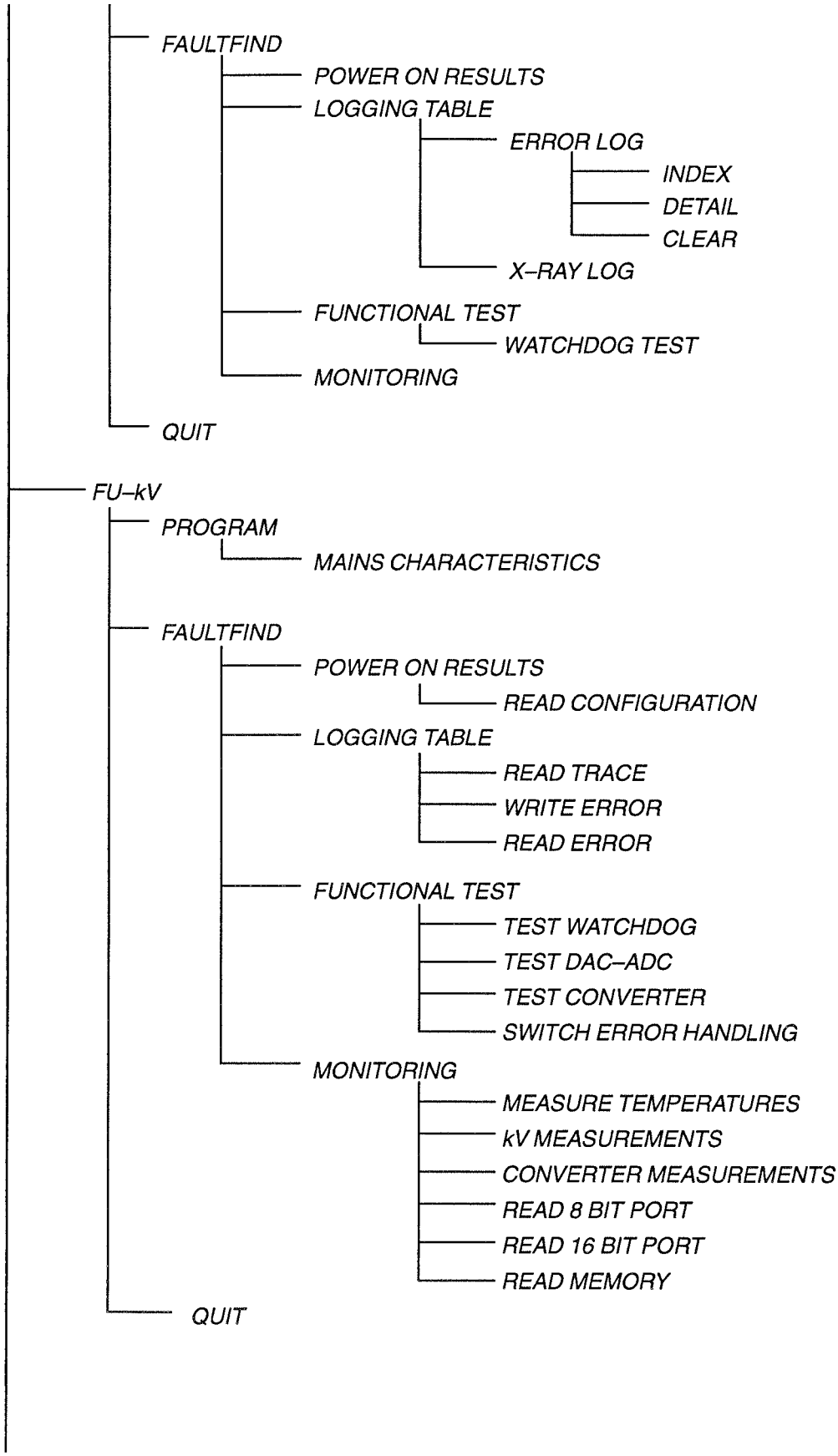

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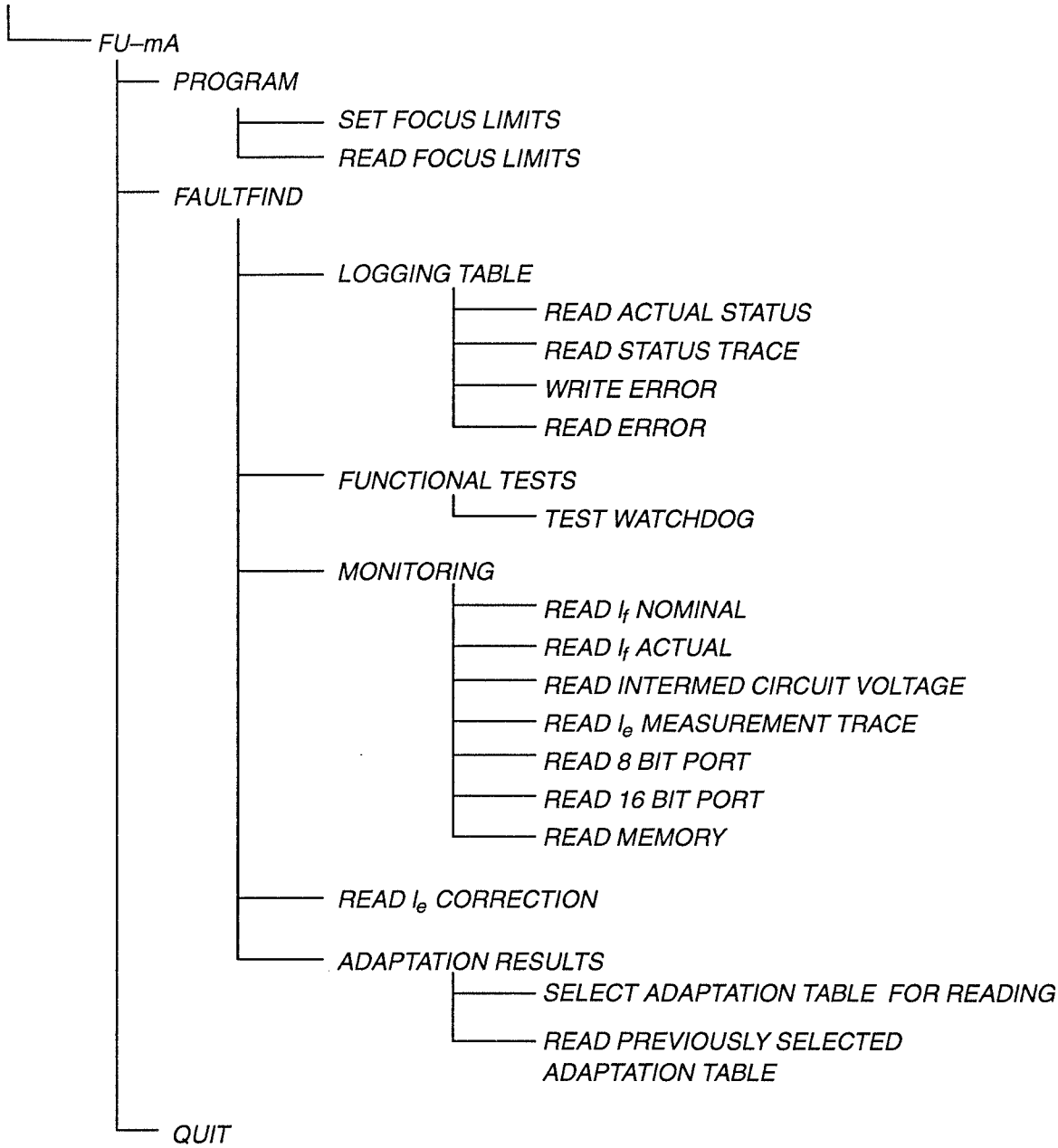

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4.4. Saving data on disk and restoring data (being prepared)

All configurations data are stored in battery–buffered CMOS areas.

Therefore, these data should be saved on disk as a backup.

In case data get lost they can easily be restored in the CMOS areas after the error source has been eliminated.

Note

It is not possible to save the adaptation data of the tubes connected as a backup.

Therefore the tubes must be adapted again after the data has been restored.

Saving of data:

- Select option *Backup* in menu *CU/ ACCEPT/ BACKUP – RESTORE.*
- Insert the backup disk found in the service documentation in disk drive A: of the service PC.
- Start the backup with <RETURN>.

Restoring of data:

- Select option *Restore* in menu *CU/ ACCEPT/ BACKUP – RESTORE.*
- Insert the backup disk found in the service documentation in disk drive A: of the service PC.
- Start the restoring of data in the CMOS area with <RETURN>.
- Adapt again the tubes connected with menu *CU/ ADJUST/ TUBE ADAPTATION/ TUBE 1 ... 3.*

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5. Initialization phase of the generator

Switch–on of the generator

|

Pulling–up of ENK 2

|

Selftest of ...

| ..... control desk C: All LED elements and the buzzer are switched on for about ..... s.

| ..... central unit EZ139: The computer boots within about ..... s.

| ..... kV control EZ130: voltage E is measured in the d.c. intermediate circuit.

| ENK1 is switched on.

| ..... mA control EZ119:

| ..... basic interface EZ150:

| ..... rotor control EYA:

|

| Indicating device: The red status LED of the associated printed–circuit board or assembly is illuminated.

|

|

When the selftests have successfully been completed, the status LED's are blinking.

|

The central unit establishes connection to each functional unit via the CAN bus.

|

| Indicating device: The red status LED of the associated printed–circuit board or assembly grows dark.

|

|

The generator is internally ready.

|

The unit connected sends EXTERNAL READY.

|

The green READY lamp in the operating desk is illuminated.

The generator is in the READY state.

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6. Switch–on not possible

See drawings: Z1–2.1 / 2.2 / 2.3

Z2–2

H1 on PCB EN100 is not illuminated.

Error sources:
- ENF1 was released.
  For fault–finding look in the error buffer.
- ENF1 is not switched on.
- Mains voltage, especially phase L3, is not present.
- ENF2 was released.
  Check: Low–voltage supply
  Filament circuit
  Tube extension
  Rotor control
  External current consumers
- ENF2 is not switched on.
- PCB EN100 or its connections are not okay.

H1 on PCB EN100 is illuminated.

Error sources:
- The EMERGENCY–OFF circuit is open.
- The operating desk is not connected.

7. Error numbers

7.1. Error classification

Error
- Analysed
  - Displayed
  - Not displayed
- Not analysed
  - Displayed
  - Not displayed

Errors are displayed in a code consisting of 4 characters.

Analysed errors:

- These errors are indicated by 4 digits.
- The first two digits indicate the functional unit reporting the error.
  01xx = CU–functional unit is concerned
  02xx = kV–functional unit is concerned
  03xx = mA–functional unit is concerned
- The last two digits indicate the assembly which is defective.

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Not analyzed errors:

- These errors are indicated by 2 digits and 2 letters.
- The first two digits indicate the functional unit reporting the error.
- The last two letters indicate the error symptom.

Displayed errors:

- These errors are indicated on the display of the operating desk for the customer.
- The customer must call the service.

  The customer can inform the service about the respective error number and the service can order the spare parts needed at an early stage of the maintenance procedure.

Not displayed errors:

- These errors are not relevant for the customer.
- In case an error of this category occurs frequently within a certain period of time, a displayed error can be generated.

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7.2. Error list

Sources of error codes indicated in the first two digits:

00=CU	01=FU_DRC	02=FU_kV	03=FU_mA_a	04=FU_mA_b	05=FU_mA_c
06=FU_mA_d	07=FU_CIE	08=FU_HI_a	09=FU_HI_b	10=FU_RC_a	11=FU_RC_b
12=FU_RC_c	13=FU_AD_a	14=FU_AD_b	15=FU_AD_c	16=FU_AD_d	17=FU_MDO
18=FU_ANA					

Class: Fatal error, Error, Warning

Error	class	explanation
00B0		error in service user interface
00B1		IIM was not expected by gen_order_list
00B2		HI order is not expected – NO member in display_tab
00B3		NVRAM: data language selector invalid
00B4		ADopmes: required message is not valid
00B5		ADsynta: inputparameter out of range
00BA		NVRAM: data of RGDV are invalid
00BB		NVRAM: basedata of RGU;are invalid
00BC		NVRAM: statedata of RGU are invalid
00BD		NVRAM: data of APR are invalid
00BE		NVRAM: data of active RGU are invalid
00BF		NVRAM: data of RGKeys are invalid
00BG		no more APR menus available
00BH		display position collision
00BI		invalid sublayer type for operation
00BJ		menu name not found
00BK		APR is assigned to a different RGU
00BL		menu name already exists
00BM		max display position reached
00BN		APR not found in this menu
00BO		APR is not assigned to any RGU
00BP		NVRAM: data of menu tree are invalid
00CA		CA_err_DPRAM_too_small
00CB		received IIM has invalid number
00CC		dor frame repeat counter overflow
00CE		dor signal conflict
00CF		CAN controller interrupt timeout, no expected interrupt of CAN controllerer
00CG		dot response mailbox type wrong

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Error	class	explanation
00CH		invalid tbdor (proc.–) parameter FU_type
00CI		CA_err_noFU_ack_at_bus
00CJ		CA_err_confi_successfull
00CK		CA_err_confi_no_success
00DA		no CPU access to CAN controller
00DB		CAN chip reset ot achnowledged
00DD		check of DPRAM failed
00DE		unexpected value in CAN chip interrupt pointer register
00DF		CAN chip state undefined
00DG		CAN chip error active after passive
00DH		CAN chip state error passive
00DI		CAN chip state bus off
00DJ		CAN chip state DPRAM error
00DK		CAN chip state DPRAM error and passive
00Ex		error$code$ER
00G0		ER_CU_undefined_case
00G1		ER_CU_err_send_internal_CAN
00G2		ER_CU_err_init_internal_CAN
00Hx		ER_error$code$HW
00I0		ER_IO_test
00I1		ER_IO_wrong_IOtab_id
00I2		ER_IO_no_int_reason_sbus
00I3		ER_IO_no_int_reason_XSbus
00I4		ER_IO_WD_error_FU
00Kx		ER_error$code$HC
00L1		GC: checksum error
00L2		GC: data access error
00L3		GC: limit data error
00L4		GC: limits inconsistent
00L5		GC: calculation error
00L6		GC: function not implemented
00Mx		ER_error$code$MC
00PA		ER_DR_IIM_unknown
00PB		ER_DR_mode_unknown
00PC		ER_DR_limit_overflow

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Error	class	explanation
00S?		SE_err_unexpected
00SA		SE_err_no_space_at_destination
00SB		SE_err_base_out_of_range
00SC		SE_err_value_too_large
00SD		SE_err_term_not_found
00SE		SE_err_description
00SF		SE_err_item_type_not_known
00SG		SE_err_int_type_not_known
00SH		SE_er_value_negative
00SI		SE_err_no_space_at_dest_buffer
00SJ		SE_err_syntax_wrong
00SK		SE_err_string_too_long
00SL		SE_err_string_truncated
00SM		SE_err_TDL_segment_overflow
00SN		SE_err_FU_Reference_Table_full
00SO		SE_err_Node_ID_unknown
00SP		SE_err_FU_Code_unknown
00SQ		SE_err_Syntax_node_ID
00SR		SE_war_no_node_ID
00SS		SE_err_not_performed
00ST		SE_err_RMX
00SU		SE_war_alt_not_found
00SV		SE_err_mail_corrupted
00SW		SE_err_proc_id_unknown
00SX		SE_err_mA_incompatible
00SY		SE_err_FU_off_failed
00SZ		SE_err_wrong_response
00Tx		error$code$TS
00Ux		ER_error$code$SC
00X0		ER_wrong_SWtim_id
00X1		ER_wrong_SWtim_mode
00X2		ER_wrong_SWtim_msgtype
00X3		ER_XR_DWORD_no_BYTE3
00X4		ER_XR_backup_timeout
00X5		ER_XR_X_rot_timeout

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Error	class	explanation
02AB		procedure called with wrong parameter
02AC		wrong index for table access
02AD	E	rong do case entry
02AE	W	unknown IIM received
02AF	W	IIM parameter out of range
02EA	F	interrupt 0: devide by zero
02EB	F	interrupt 1: single step
02EC	F	interrupt 2: NMI
02ED	F	interrupt 3: breakpoint
02EE	F	interrupt 4: overflow exception
02EF	F	interrupt 5: array bounds exception
02EG	F	interrupt 6: unused opcode
02EH	F	interrupt 7: ESC opcode
02EI	F	CAN connection to CU lost
02GA	W	interpolation not possible
02HA	E	kV nominal value out of range
02HB	E	kV nominal value out of range
02HC	W	nominal value out of range
02HD	E	nominal value out of range
02HE	W	kV value during standby too large
02HF	E	kV value during standby too large
02HG	W	kV actual value out of range
02HH	E	kV actual value out of range
02HI	W	E value during standby out of range
02HJ	E	E value during standby out of range
02HK	W	E value during high tension out of range
02HL	E	E value during high tension out of range
02HM	W	converter 1 temperature out of range
02HN	E	converter 1 temperature out of range
02HO	W	converter 2 temperature out of range
02HP	E	converter 2 temperature out of range
02HQ	W	high tension tank temperature out of range
02HR	E	high tension tank temperature out of range
02HS	W	divider test cathode out of range
02HT	E	divider test cathode out of range

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Error	class	explanation
02HU	W	divider test anode out of range
02HV	E	divider test anode out of range
02HW	W	kV anode out of range, asymmetric ?
02HX	E	kV anode out of range, asymmetric ?
02MA	E	state request not accepted because of grid mode
02MB	E	state request not accepted because of error state
02MC	W	state requested by CU unknown
02OA		RMX error: timeout
02OB		RMX error: memory
02OC		RMX error: busy
02OE		RMX error: limit
02OF		RMX error: context
02OG		RMX error: exist
02OH		RMX error: state
02OI		RMX error: not configured
02OJ		RMX error: interrupt saturation
02OK		RMX error: interrupt overflow
02OL		RMX error: transmission
02OM		RMX error: divide by zero
02ON		RMX error: overflow
02OO		RMX error: type
02OP		RMX error: parameter
02OQ		RMX error: bad call
02OR		RMX error: array bound
02OS		RMX error: NDP error
02OT		RMX error: illegal opcode
02OU		RMX error: emulator trap
02OV		RMX error: interrupt table limit
02OW		RMX error: CPU xfer data limit
02OX		RMX error: wrap around
02OY		RMX error: check exception
02OZ		RMX error: unknown
02RA	W	grid mode changeover requested during prep
02RB	W	tube switch requested during preparation
02RC	W	requested P out of range

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Error	class	explanation
02SA	W	not enough space at destination
02SB	W	base out of range
02SC	W	value too large
02SD	W	terminator not found
02SE	W	terminator not found or description too long
02SF	W	item type not known
02SG	W	internal type definition not known
02SH	W	value is negative, absolute value only used
02SI	W	not enough space at the destination buffer
02SJ	W	syntax wrong or expression too long
02SK	W	string too long
02SL	W	string truncated
02SO	W	unknown table ID received
02SP	W	access level too low
02SQ	W	unknown action requested
02SR	W	routing info present or message corrupt
02SS	W	source buffer too small for incoming message
02ST	W	CAN buffer too small for outgoing message
02SU	W	requested action not available
02UA	E	HW configuration identifier wrong
02UB	W	Set Up request received during preparation
02WA	W	wrong tube selected
02WB	E	wrong tube selected
02WC	W	EN_X_C signal faulty
02WD	E	EN_X_C signal faulty
02WE	W	wrong grid mode selected
02WF	E	wrong grid mode selected
02WG	W	tube arcing detected
02WH	E	tube arcing detected
02WI	W	kV over voltage detected
02WJ	E	kV over voltage detected
03AA	W	internal parameter error
03AB	W	wrong task–parameter activation of CU
03AC	W	Ie regulation active on two filaments
03AI	W	wrong IIM received

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Error	class	explanation
03BA	W	coordinates not monotonous
03BB	W	not enough measurement values for adaptation
03EA	F	CPU interrupt 0
03EB	F	CPU interrupt 1
03EC	F	CPU interrupt 2
03ED	F	CPU interrupt 3
03EE	F	CPU interrupt 4
03EF	F	CPU interrupt 5
03EG	F	CPU interrupt 6
03EH	F	CPU interrupt 7
03EI	F	CAN is unable to send a message to CU
03FA	W	checksum does not match a table in the NVRAM sector
03FB	W	standby filament current not found in the table1
03FC	F	no NVRAM found or plugged in
03FD	W	NVRAM empty
03GA	W	linit error
03GB	W	real underflow
03GC	W	real overflow
03GD	W	dword overflow
03GE	W	integer overflow
03GF	W	word overflow
03GG	W	singular matrix
03HA	F	software FU_mA does not recognize hardware
03HB	E/W	intermediate circuit voltage too low
03HF	W	undefined analog input channel
03IA	W	adaptation can not be completed
03IC	W	no measured values at the end of the Ie adaptation
03ID	W	Ie adaptation values not available
03KA	W	conditional mode activated without Iet parameter
03MA	W	internal synchronisation error during status change
03MB	W	status change not allowed
03MC	W	FU init data not expected
03OA	F	E$TIME
03OB	F	E$MEM
03OC	F	E$BUSY

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Error	class	explanation
03OD	F	E$LIMIT
03OE	F	E$CONTEXT
03OF	F	E$EXIST
03OG	F	E$STATE
03OH	F	ENOTCONFIGURED
03OI	F	EINTSATURATION
03OJ	F	EINTOVERFLOW
03OK	F	E$TRANSMISSION
03OL	F	E$ZERO$DIVED
03OM	F	E$OVERFLOW
03ON	F	E$TYPE
03OO	F	E$PARAM
03OP	F	EBADCALL
03OQ	F	E$ARRAY$BOUND
03OR	F	ENDPERROR
03OS	F	E$ILLEGAL$OPCODE
03OT	F	E$EMULATOR$TRAP
03OU	F	EINTTABLE$LIMIT
03OV	F	E$CPUXFER$DATA$LIMIT
03OW	F	ESEGWRAP$AROUND
03OX	F	E$CHECK$EXCEPTION
03OY	F	E$UNKNOWN$RMX$EXCEPT
03PA		emmission current zero measured
03PB	W	measured value of Ie out of tolerance
03PC	E	Ie out of tolerance
03PD	W	internal synchronisation error
03PE	F	emmission current measured with grid closed
03SB	W	filament current actual value out of tolerance
03SC	E	If SW out of tolerance
03SD	E	If actual out of tolerance
03SE	F	If actual out of tolerance
03SF	W	If nominal out of tolerance
03SG	E	If nominal out of tolerance
03SH	F	If nominal out of tolerance
03SI	F	filament retrigger time expired

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8. Converter test

See drawings: Z1–3.2 / 3.3

Z2–3

- Call menu *FU–kV/ FAULTFIND/ FUNCTIONAL TEST/ TEST CONVERTER.*

(being prepared)

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9. Mnemonic and routing list

Example:

MNEMONIC	explanation chain value measuring point trigger point remarks part of supply
AC_0V_XG	mains supply 0 V X-ray generator EZ102X1:D4–EZ102X1:B4–EZ102X1:Z4–EZ119X1:D24–EZ119X1:B24–EZ119X1:Z24–EZX13:2–EZX14:2–EZX15:2–
AC_230V_L1	mains supply 230V AC phase 1 EZ102X1:D2–EZ102X1:B2–EZ119X1:Z2–EZX13:1–EZX14:1–EZX15:1–
AC_230V_L2	mains supply 230V AC phase 2 EZ119X1:D26–EZ119X1:B26–EZ119X1:Z26–EZX13:3–
AV_AN	high tension actual value anode side 0V...+3.75V 1V ≙ 20kV measuring point EZ130X4
AV_CA	high tension actual value cathode side 0V...+3.75V 1V ≙ 20kV measuring point EZ130X5
AV_HT	high tension actual value 0...+7.5V 1V ≙ 20kV measuring point EZ130X3
BG_RL_CC_CO	beginning relay circuit from correction (PSC) EWAX24:10– –EWBX24:10–
BG_RL_CC_PG	beginning relay circuit from program (APR) EWAX24:1– –EWBX24:1–
CAN_H	generator CAN high active EZ119X2:C3–EZ130X2:C3–EZ139X2:C3–EZ150X2:C3–EZX44:10–EZX45:10–EZX46:10– –C300X1:10–EZX51:3–EZX52:7–EZX72– EWAX51:10–EWAX52:10–EWA100X2:C3– –EWBX51:10–EWBX52:10–EWB100X2:C3– 0V/5V measuring point EZX72 part of: XRG bus
CAN_L	generator CAN low active EZ119X2:A3–EZ130X2:A3–EZ139X2:A3–EZ150X2:A3–EZX44:2–EZX45:2–EZX46:2– –C300X1:2–EZX51:2– EZX52:2–EZX71– EWAX51:2–EWAX52:2–EWA100X2:A3– –EWBX51:2–EWBX52:2–EWB100X2:A3– 0V/5V measuring point EZX71 part of: XRG bus

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CAN_N	system CAN negative data EZ139X1:C16–EZX42:2–EZX43:2– part of: system CAN
CAN_P	system CAN positive data EZ139X1:A16–EZX42:7–EZX43:7– part of: system CAN
CM_EX_SW_1	common for exposure switch of release decade 1 –EWA100X1:C5–EWAX1:10– –EWB100X1:C5–EWBX1:10–
CM_EX_SW_2	common for exposure switch of release decade 2 –EWA100X1:C7–EWAX2:10– –EWB100X1:C7–EWBX2:10–
CM_EX_SW_3	common for exposure switch of release decade 3 –EWA100X1:C9–EWAX3:10– –EWB100X1:C9–EWBX3:10–
CM_EX_SW_4	common for exposure switch of release decade 4 –EWA100X1:C11–EWAX4:10– –EWB100X1:C11–EWBX4:10–
CM_TH	common for radiation indication –EZ130X1:C12–EZ150X1:C29–EZX1:6–EZX3:7–
CM_TH_SW	common for tube housing switch –EZ130X1:C11–EZX3:4– 0V
CTRL_X/	signal bus X–ray request command –EZ139X1:A4–EZX23:4–EZX45:5–EWAX51:5–EWAX52:5–EWA100X2:C25– –EZ130X1:C11–EZX3:4– 0V/15V –EWBX51:5–EWBX52:5–EWB100X2:C25– old: exposures with fast pulses, exposure command part of: signal bus
CTRL_X_C/	control X–ray command –EZ119X2:C6–EZ130X2:C6–EZ139X2:C6–EZ150X2:C6–EZX52:8–EZX74– 0V/5V measuring point EZX74 driven by CU, active, if STOP_X_C/ not active, immediately inactive if STOP_X_C/ active, controls all non AEC exposures with exposure timer or AEC exposures with DRC timer HTON high tension on command (internal generator command) resp. 20/21 signal (external = old world) part of: XS/XRG bus
CU_CT1_1	cooling unit contact 1_1 –EZ150X1:A22–EZX2:6–
CU_CT1_2	cooling unit contact 1_2 –EZ150X1:C22–EZX2:7–
CV1_GND	converter power part 1 ground –EZX24:8–EZX24:20–EZX24:21–EZ130X1:A7–EZ130X1:A8–EZ130X1:C8– –EQ100X1:8–EQ100X1:20–EQ100X1:21–

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CV1_ID	converter power part 1 identification –EQ100X1:19–EZX24:19–EZ130X1:A6– open 5V, low active 0V
CV1_OL/	converter power part 1 overload –EQ100X1:7–EZX24:7–EZ130X1:C7– open +26V, low active 0V
CV1_TM	converter power part 1 temperature –EQ100X1:6–EZX24:6–EZ130X1:C6– 0.3...3.5V (temperature range follows)
CV2_GND	converter power part 2 ground –EZX34:8–EZX34:20–EZX34:21–EZ130X1:A28–EZ130X1:A29–EZ130X1:C29– –E2Q100X1:8–E2Q100X1:20–E2Q100X1:21–
CV2_ID	converter power part 2 identification –E2Q100x1:19–EZX34:19–EZ130X1:A27– open 5V, low active 0V
CV2_OL	converter power part 2 overload –E2Q100X1:7–EZX34:7–EZ130X1:C28– open +26V, low active 0V
CV2_TM	converter power part 2 temperature –E2Q100X1:6–EZX34:6–EZ130X1:C27– 0.3...3.5V (temperature range follows)
DR_BV_0V	dose rate (signal) reference of image intensifier –EZX61:3–EZ139X2:C18– negative potential of II unit, 0V ±50mV against generator ground differential signal with DR_BV_SG part of: dose rate control
DR_BV_SG	dose rate signal of image intensifier –EZX61:8–EZ139X2:A18– positive potential, 0...10V differential signal with DR_BV_0V part of: dose rate control
DR_FQ_NG	dose rate signal (pulses) negative –EZX61:6–EZ139X2:C20– 0.1 µR / pulse optocoupled interface, dose rate signal = pulsed frequency part of: dose rate control
DR_FQ_PO	dose rate signal (pulses) positive –EZX61:1–EZ139X2:A20– 0.1 µR / pulse optocoupled interface, dose rate signal = pulsed frequency part of: dose rate control

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DR_TV_NT	dose rate of TV chain signal negative, fluoro regulation –EZX61:4–EZ139X2:C19– ± 12V minus polarity dual voltage differential signal +12V = 200% light, 0V = 100% light, –12V = 50% light part of: dose rate control
DR_TV_PT	dose rate of TV chain signal positive, fluoro regulation –EZX61:9–EZ139X2:A19– ± 12V positive polarity dual voltage differential signal –12V = 200% light, 0V = 100% light, +12V = 50% light part of: dose rate control
DS_BV_0V	dose (signal ramp) reference of image intensifier –EZX61:2–EZ139X2C17– negative potential of II unit, 0V ± 50mV against generator ground differential signal with DS_BV_SG part of: dose rate control
DS_BV_SG	dose signal ramp of image intensifier signal –EZX61:7–EZ139X2:A17– 0...10V, polarity positive differential signal with DS_BV_0V part of: dose rate control
DS_MC_0V	dose (signal ramp) reference of selected measuring chamber –EZ150X2:C16–EZ139X2:C16– negative potential of selected measuring chamber, 0V ± 50mV against generator ground differential signal with DS_MC_SG
DS_MC_SG	dose signal ramp of selected measuring chamber –EZ150X2:A16–EZ139X2:A16– 0...12V differential signal with DS_MC_0V
E_MC_NG	E value converter DC supply negative –EQ100X1:5–EZX24:5–EZ130X1:C5– 0...–12V ≙ 0...–375V
E_MC_PO	E value converter DC supply positive –EZ100X1:18–EZX24:18–EZ130X1:A5– 0...+12V ≙ 0...+375V
E_NG	E value converter DC supply negative –EQ100X1:5–EZX24:5–EZ130X1:C5– 0...–12V ≙ 0...–375V
E_PO	E value converter DC supply positive –EQ100X1:18–EZX24:18–EZ130X1:A5– 0...+12V ≙ 0...+375V

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EN_X/	signal bus enable X–ray –EZ139X1:C2–EZX23:15–EZX45:11–EZX46:11–C300X1:11– –EWAX51:11–EWAX52:11–EWA100X2:C26– –EWBX51:11–EWBX52:11–EWB100X2:C26–1– part of: signal bus 0V/15V low active
EN_X_C/	enable X–ray command –EZ119X2:C7–EZ130X1:A9–EZ130X1:A30–EZ130X2:C7–EZ139X2:C7–EZ150X2:C7–EZX52:9–EZX76– 0V/5V low active measuring point EZX76 driven by CU if EN_X/ active (low) part of: XS/XRG bus
ENAX/	converter power part 1 enable –EZ130X1:A9–EZX24:22–EQ100X1:22–EZ130X1:A30–EZX34:22–E2Q100X1:22– parallel to CV2_EN
ET_RD_EX_1	external ready for exposure tomo 1 –EWAX11:6– part of: tomo ready contact
ET_RD_EX_2	external ready for exposure tomo 2 –EWAX12:6– part of: tomo ready contact
EX_ON	exposure on –EWAX14:7–EWA100X2:A9– –EWBX14:7–EWB100X2:A9– part of: exon old world
EX_UN_RD/	examination ? ready –EWB100X1:C20–EWBX22:6– part of: angio
FD_C_CH1	central field measuring chamber 1 –EZ150X1:C4–EZX21:12– 15V, R_i = 220 Ω
FD_C_CH2	central field measuring chamber 2 –EZ150X1:A4–EZX22:12– 15V, R_i = 220 Ω
FD_C_CH3	central field measuring chamber 3 –EZ150X1:C10–EZX31:12– 15V, R_i = 220 Ω
FD_C_CH4	central field measuring chamber 4 –EZ150X1:A10–EZX32:12– 15V, R_i = 220 Ω
FD_C_CH5	central field measuring chamber 5 –EZ150X1:C16–EZX41:12– 15V, R_i = 220 Ω

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FD_L_CH1	left field measuring chamber 1 –EZ150X1:C3–EZX21:11– 15V, R_i = 220 Ω
FD_L_CH2	left field measuring chamber 2 –EZ150X1:A3–EZX22:11– 15V, R_i = 220 Ω
FD_L_CH3	left field measuring chamber 3 –EZ150X1:C9–EZX31:11– 15V, R_i = 220 Ω
FD_L_CH4	left field measuring chamber 4 –EZ150X1:A9–EZX32:11 15V, R_i = 220 Ω
FD_L_CH5	left field measuring chamber 5 –EZ150X1:C15–EZX41:11– 15V, R_i = 220 Ω
FD_R_CH1	right field measuring chamber 1 –EZ150X1:C5–EZX21:3 15V, R_i = 220 Ω
FD_R_CH2	right field measuring chamber 2 –EZ150X1:A5–EZX22:3– 15V, R_i = 220 Ω
FD_R_CH3	right field measuring chamber 3 –EZ150X1:C11–EZX31:3– 15V, R_i = 220 Ω
FD_R_CH4	right field measuring chamber 4 –EZ150X1:A11–EZX32:3– 15V, R_i = 220 Ω
FD_R_CH5	right field measuring chamber 5 –EZ150X1:C17–EZX41:3– 15V, R_i = 220 Ω
FI_TF1_1	filament transformer 1 line 1 –EZ119X1:D4–EZ119X1:B4–EZ119X1:Z4–EZX12:1–EG106X15:1– max. 300Veff or ± 150V against ground, 100...20kHz
FI_TF1_2	filament transformer 1 line 2 –EZ119X1:D6–EZ119X1:B6–EZ119X1:Z6–EZX12:2–EG106X15:2– max 300Veff or ± 150V against ground, 100...20kHz
FI_TF2_1	filament transformer 2 line 1 –EZ119X1:D8–EZ119X1:B8–EZ119X1:Z8–EZX12:4–EG106X15:4 max. 300Veff or ± 150V against ground, 100...20kHz

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FI_TF2_2	filament transformer 2 line 2 –EZ119X1:D10–EZ119X1:B10–EZ119X1:Z10–EZX12:5–EG106X15:5– max. 300Veff or ± 150V against ground, 100...20kHz
GND	
GND_15V	ground (+15V) for desk handswitch –C300X3:1–C300X3:2–
GNDC	CAN bus ground EZ139X1:C17–EZX43:3–EZX42:3–EZX42:6–EZX43:6–EZX44:9– part of: system CAN
GNDS	signal bus ground –EZ139X1:A1–EZ139X1:C1–EZX23:1–EZX23:14–EZX44:15–EZX45:15–EWAX51:15–EWAX52:15– –EWBX51:15–EWBX52:15– part of: signal bus negative
GS_OUTPUT_NG	grid switch output negative EZ119X6 shield
GS_OUTPUT_PO	grid switch output positive EZ119X6 core
HT_AN	high tension anode side actual value –EZ130X1:C17–EZX35:2–EG106X14:2– 0...+10V ≙ 0...+100 kV
HT_AN_GND	high tension anode side ground –EZ130X1:A17–EZX35:10–EG106X14:10– 0V
HT_CA	high tension cathode side actual value –EZ130X1:C16–EZX35:1–EG106X14:1– 0...–10V ≙ 0...–100kV
HT_CA_GND	high tension cathode side ground –EZ130X1:A16–EZX35:9–EG106X14:9– 0V
HT_CH_SW_1	high tension changeover switch 1
HT_CH_SW_2	high tension changeover switch 2
HT_SW_1	high tension switch 1
HT_SW_2	high tension switch 2
HT_SW_3	high tension switch 3

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I1_1 IGBT1 power part 1 EQ100 = 4512 108 05882
I1_1/ IGBT1 power part 1 EQ100 ≥ 4512 108 08621 *
EZ130X1:C1–EZX24:1–EQ100X1:1–

I1_1/ IGBT1 power part 1 EQ100 = 4512 108 05882
I1_1 IGBT1 power part 1 EQ100 ≥ 4512 108 08621 *
–EZ130X1:A1–EZX24:14–EQ100X1:14–
value (range): on = 1.2V off = 3.7V against ground * = X10
measuring point EQ100 R25 end to X1 * EQ100 X6/I1

I1_2 IGBT2 power part 1 EQ100 = 4512 108 05882
I1_2/ IGBT2 power part 1 EQ100 ≥ 4512 108 08621 *
–EZ130X1:C2–EZX24:2–EQ100X1:2–

I1_2/ IGBT2 power part 1 EQ100 = 4512 108 05882
I1_2 IGBT2 power part 1 EQ100 ≥ 4512 108 08621 *
–EZ130X1:A2–EZX24:15–EQ100X1:15–
value (range): on = 1.2V off = 3.7V against ground * = X10
measuring point EQ100 R27 end to X1 * EQ100 X7/I2

I1_3 IGBT3 power part 1 EQ100 = 4512 108 05882
I1_3/ IGBT3 power part 1 EQ100 ≥ 4512 108 08621 *
–EZ130X1:C3–EZX24:3–EQ100X1:3–

I1_3/ IGBT3 power part 1 EQ100 = 4512 108 05882
I1_3 IGBT3 power part 1 EQ100 ≥ 4512 108 08621 *
–EZ130X1:A3–EZX24:16–EQ100X1:16–
value (range): on = 1.2V off = 3.7V against ground * = X10
measuring point EQ100 R29 end to X1 * EQ100 X8/I3

I1_4 IGBT4 power part 1 EQ100 = 4512 108 05882
I1_4/ IGBT4 power part 1 EQ100 ≥ 4512 108 08621 *
–EZ130X1:C4–EZX24:4–EQ100X1:4–

I1_4/ IGBT4 power part 1 EQ100 = 4512 108 05882
I1_4 IGBT4 power part 1 EQ100 ≥ 4512 108 08621 *
–EZ130X1:A4–EZX24:17–EQ100X1:17–
value (range): on = 1.2V off = 3.7V against ground * = X10
measuring point EQ100 R31 end to X1 * EQ100 X9/I4

I2_1 IGBT1 power part 2 E2Q100 = 4512 108 05882
I2_1/ IGBT1 power part 2 E2Q100 ≥ 4512 108 08621 *
–EZ130X1:C22–EZX34:1–E2Q100X1:1–

I2_1/ IGBT1 power part 2 E2Q100 = 4512 108 05882
I2_1 IGBT1 power part 2 E2Q100 ≥ 4512 108 08621 *
–EZ130X1:A22–EZX34:14–E2Q100X1:14
value (range): on = 1.2V off = 3.7V against ground * = X10
measuring point EQ100 R25 end to X1 * E2Q100 X6/I1

I2_2 IGBT2 power part 2 E2Q100 = 4512 108 05882
I2_2/ IGBT2 power part 2 E2Q100 ≥ 4512 108 08621 *
–EZ130X1:C23–EZX34:2–E2Q100X1:2–

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I2_2/	IGBT2 power part 2 E2Q100 = 4512 108 05882
I2_2	IGBT2 power part 2 E2Q100 ≥ 4512 108 08621 * –EZ130X1:A23–EZX34:15–E2Q100X1:15– value (range): on = 1.2V off = 3.7V against ground * = X10 measuring point EQ100 R27 end to X1 * E2Q100 X7/I2
I2_3	IGBT3 power part 2 E2Q100 = 4512 108 05882
I2_3/	IGBT3 power part 2 E2Q100 ≥ 4512 108 08621 * –EZ130X1:C24–EZX34:3–E2Q100X1:3–
I2_3/	IGBT3 power part 2 E2Q100 = 4512 108 05882
I2_3	IGBT3 power part 2 E2Q100 ≥ 4512 108 08621 * –EZ130X1:A24–EZX34:16–E2Q100X1:16– value (range): on = 1.2V off = 3.7V against ground * = X10 measuring point EQ100 R29 end to X1 * E2Q100 X8/I3
I2_4	IGBT4 power part 2 E2Q100 = 4512 108 05882
I2_4/	IGBT4 power part 2 E2Q100 ≥ 4512 108 08621 * –EZ130X1:C25–EZX34:4–E2Q100X1:4–
I2_4/	IGBT4 power part 2 E2Q100 = 4512 108 05882
I2_4	IGBT4 power part 2 E2Q100 ≥ 4512 108 08621 * –EZ130X1:A25–EZX34:17–E2Q100X1:17– value (range): on = 1.2V off = 3.7V against ground * = X10 measuring point EQ100 R31 end to X1 * E2Q100 X9/I4
IT_0V	emitter 0V exposure on signal –EWAX14:9–EWA100X2:C9– –EWBX14:9–EWB100X2:C9– part of exon old world
Iu	stator current U low speed measuring point EYAX22
Iw	stator current W low speed measuring point EYAX21
MN_EM_OF	mains power emergency off –EZX4:1–EZX47:6–EN100X1:6–
MN_ON	mains on –EZX44:14–EZX46:6–C300X1:6–EZX47:2–EN100X1:2–
NG_15V	– 15 V supply Vee –EZ102X2:D24–EZ102X2:B24–EZ102X2:Z24–EZ119X2:A12–EZ119X2:C12–EZ130X2:A12–EZ130X2:C12–EZ139X2:A12–EZ139X2:C12–EZ150C2:A12–EZ150X2:C12–EZX21:6–EZX22:6–EZX31:6–EZX32:6–EZX35:15–EZX41:6–EZX51:8–EG106X14:15– –EZX31:6–EZX32 min.–14.5V nom–15V max.–15.5V
PO_12V	+ 12 V supply –EZX46:7–C300X1:7–EZX47:1–EN100X1:1–

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PO_15V	+ 15 V supply Vdd –EZ102X2:D22–EZ102X2:B22–EZ102X2:Z22–EZ119X2:A11–EZ119X2:C11–EZ130X2:A11–EZ130X2:C11–EZ139X2:A11–EZ139X2:C11–EZ150X2:A11–EZ150X2:C11–EZX21:5–EZX22:5–EZX31:5–EZX32:5–EZX35:7–EZX41:5–EZX44:12–EZX44:13–EZX46:5–C300X1:5–EZX51:7–EZX2:8–EZX2:9–EG106X14:7– 4min.+14.5V nom+15V max.+15.5V
PO_26V	+ 26 V supply –EZ102X2:D28–EZ102X2:B28–EZ102X2:Z28–EZ119X2:A14–EZ119X2:C14–EZ130X2:A14–EZ130X2:C14–EZ139X2:A14–EZ139X2:C14–EZ150X2:A14–EZ150X2:C14–EZX1:5–EZX2:3–EZX3:9–EZX11:1–EZX17:1–EZX18:1–EWAX1:4–EWAX2:4–EWAX3:4–EWAX4:4–EWAX41:1–EWAX23:9–EWAX24:5–EWA100X2:A14–EWA100X2:C14– –EWBX1:4–EWBX2:4–EWBX3:4–EWBX4:4–EWBX41:1–EWBX21:9–EWBX23:9–EWBX24:5–EWB100X2:A14–EWB100X2:C14–EQ100X2:1–E2Q100X2:1–
PO_26V_1	+26 V supply optional –EZ102X2:D32–EZ102X2:B32–EZ102X2:Z32–EZX19:1–EZX20:1–
PO_26V_RE	+26 V supply reverse –EWAX42:1–EWAW12–EWAW11– –EWBX42:1–EWBW12–EWBW11– if generator and system release voltage are of the same polarity PO_26_RE +26V, if not PO_26_RE = 0V against –24V
PO_400V	+400 V supply measuring chamber –EZ150X1:A1–EZ150X1:C1–EZX21:1–EZX22:1–EZX31:1–EZX32:1–EZX41:1 +400V , Ri=100k
PO_5V	+ 5 V supply Vcc –EZ102X2:D2–EZ102X2:B2–EZ102X2:Z2–EZ102X2:D4–EZ102X2:B4–EZ102X2:Z4–EZ102X2:D6–EZ102X2:B6–EZ102X2:Z6–EZ119X2:A1–EZ119X2:C1–EZ119X2:A2–EZ119X2:C2–EZ130X2:A1–EZ130X2:C1–EZ130X2:A2–EZ130X2:C2–EZ139X2:A1–EZ139X2:C1–EZ139X2:A2–EZ139X2:C2–EZ150X2:A1–EZ150X2:C1–EZ150X2:A2–EZ150X2:C2–EZX46:9–C300X1:9–EZX51:4–EZX51:5–EZX51:6 min+4.74V nom+5V max+5.25V
POWERFAIL/	power fail signal of power supply –EZ102X1:D30–EZ139X1:A10–
PW_ON	DC supply relay power on
PW_ON_NG	DC supply relay power on – –EZ130X1:A15–EZX47:9–EN100X1:9– 0V/+15V, low active
PW_ON_PO	DC supply relay power on + –EZ130X1:C15–EZX47:4–EN100X1:4– +15V
RC_ON/	rotor control on –EZ150X1:A25–EZX51:1–
RC_RD/	rotor control ready –EZ150X1:C25–EXZ51:9–EYAX1:9(low speed)– measuring point EYAX25 low speed
RC_ST_2/	rotor control stator 2 –EZ150X1:A26–EZX16:1(low speed)–EY100X3:1(high speed)–(EWGX14:1 or E1WGX14:1)–

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RC_ST_3/	rotor control stator 3 –EZ150X1:C26–EZX16:2(low speed)–EY100X3:2(high speed)–E1WGX14:2–E1WGX15:1–
RD_MN_ON	ready mains power on –EZX46:14–C300X1:14–EZX47:7–EN100X1:7–
RD_PR_X	ready preparing for X–ray –EZ139X1:A3–EZX23:3–EZX45:4–EZX46:4–C300X1:4– –EWAX51:4–EWAX52:4–EWA100X2:A24– –EWBX51:4–EWBX52:4–EWB100X2:A24– driven by CU part of: signal bus
REL_CH1	release (reset integrator) chamber 1 –EZ150X1:C6–EZX21:4–
REL_CH2	release (reset integrator) chamber 2 –EZ150X1:A6–EZX22:4–
REL_CH3	release (reset integrator) chamber 3 –EZ150X1:C12–EZX31:4–
REL_CH4	release (reset integrator) chamber 4 –EZ150X1:A12–EZX32:4–
REL_CH5	release (reset integrator) chamber 5 –EZ150X1:C18–EZX41:4–
RESET_C/	system RESET command –EZ119X2:A6–EZ130X2:A6–EZ139X2:A6–EZ150X2:A6–EZX45:3–EZX46:3–C300X1:3– –EZX51:10–EZX52:3–EZX73–EWAX51:3–EWAX52:3–EWA100X1:A6– –EWBX51:3–EWBX52:3–EWB100X2:A6– 0V/5V measuring point EZX73 driven by CU, active (low) if: EZ139 S1 activated, RESET_SW/ active, threatening power supply drop in, watchdog alarm, switch on (button), resets FU's drop in, part of: XS/XRG bus
RESET_SW/	signal bus reset, generator reset –EZ139X1:A2–EZX23:2–EZX44:6– low active $\tau \geq 200$ms (τ = 8.41 WP) resets CU part of: signal bus
RF_0V_CH1	0V reference value measuring chamber 1 –EZ150X1:C8–EZX21:8– differential signal with SIGN_CH1
RF_0V_CH2	0V reference value measuring chamber 2 –EZ150X1:A8–EZX22:8– differential signal with SIGN_CH2
RF_0V_CH3	0V reference value measuring chamber 3 –EZ150X1:C14–EZX31:8– differential signal with SIGN_CH3

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RF_0V_CH4	0V reference value measuring chamber 4 –EZ150X1:A14–EZX32:8– differential signal with SIGN_CH4
RF_0V_CH5	0V reference value measuring chamber 5 –EZ150X1:C20–EZX41:8– differential signal with SIGN_CH5
RG_DV_1	registration device 1 selected (EWA or EWB) or 5 (EWB) –EWA100X1:C4–EWAX1:5– –EWB100X1:C4–EWBX1:5–
RG_DV_2	registration device 2 selected (EWA or EWB) or 6 (EWB) –EWA100X1:A7–EWAX2:5– –EWB100X1:A7–EWBX2:5–
RG_DV_3	registration device 3 selected (EWA or EWB) or 7 (EWB) –EWA100X1:A9–EWAX3:5– –EWB100X1:A9–EWBX3:5–
RG_DV_4	registration device 4 selected (EWA or EWB) or 8 (EWB) –EWA100X1:A11–EWAX4:5– –EWB100X1:A11–EWBX4:5–
RG_DV_SL_1	select registration device 1 –EWB100X1:C18–EWBX21:1– part of: remote switchover cassette
RG_DV_SL_2	select registration device 2 –EWB100X1:A19–EWBX21:2– part of: remote switchover camera
RM_DR_0V	room door contact 0V –EZ150X1:C28–EZX1:10–
RM_DR_CT	room door contact –EZ150X1:A28–EZX1:8–
RQ_CH_FD_1	request to change measuring field 1 –EWBX13:4–
RQ_CH_FD_3	request to change measuring field 3 –EWBX13:6–
RQ_CH_MF_1	request change measuring field measuring chamber 1 (EWA or EWB) or 3 (EWB) –EWAX11:2– –EWBX11:2–
RQ_CH_MF_2	request change measuring field measuring chamber 2 (EWA or EWB) or 4 (EWB) –EWAX12:2– –EWBX12:2–
RQ_CO_X	
RQ_ET_RD_1	request for external ready bucky 1 (EWA or EWB) or bucky 3 (EWB) –EWAX11:9– –EWBX11:9– part of: bucky ready contact

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RQ_ET_RD_2	request for external ready bucky 2 (EWA or EWB) or 4 (EWB) –EWAX12:9– –EWBX12:9– part of: bucky ready contact
RQ_MV	
RQ_PH_X	
RQ_PL_X	
RQ_PR/	request for preparation of desk handswitch C300X3:5
RQ_SL_TO_TM	request for selection of tomo time –EWAX21:10–
RQ_SN_X/	request synchronization of X–ray –EZ139X1:C3–EZX23:16–EZX45:12–EZX46:12–C300X1:12– –EWAX51:12–EWAX52:12–EWA100X2:A25– –EWBX51:12–EWBX52:12–EWB100X2:A25– part of: signal bus
RQ_XG_EX	request X–ray generator for exposure –EWA100X1:A3–EWAX1:1–EWAX2:1–EWAX3:1–EWAX4:1–EWB100X1:A3–EWBX1:1–EWBX2:1–EWBX3:1–EWBX4:1–
RQ_XG_FL	request X–ray generator for fluoroscopy –EWA100X1:A5–EWAX1:6–EWAX2:6–EWAX3:6–EWAX4:6–EWB100X1:A5–EWBX1:6–EWBX2:6–EWBX3:6–EWBX4:6–
RQ_XG_PR_1	request X–ray generator for preparation –EWA100X1:A4–EWAX1:3– –EWB100X1:A4–EWBX1:3–
RQ_XG_PR_2	request X–ray generator for preparation –EWA100X1:C6–EWAX2:3– –EWB100X1:C6–EWBX2:3–
RQ_XG_PR_3	request X–ray generator for preparation –EWA100X1:C8–EWAX3:3– –EWB100X1:C8–EWBX3:3–
RQ_XG_PR_4	request X–ray generator for preparation –EWA100X1:C10–EWAX4:3– –EWB100X1:C10–EWBX4:3–
RX_CAN_1	system CAN 1 optional –EZ139X1:C15–EZX44:3– part of: system CAN
RX_CAN_2	system CAN 2 optional –EZX43:1–EZX44:11–
SI_PH_ID	single phase identifier –EZ130X1:C14–EZX47:5–EN100X1:5–

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SIGN_CH1	signal ramp of measuring chamber 1 –EZ150X1:C7–EZX21:7– 0...12V (24V out of range possible) differential signal with FR_0V_CH1
SIGN_CH2	signal ramp of measuring chamber 2 –EZ150X1:A7–EZX22:7– 0...12V (24V out of range possible) differential signal with RF_0V_CH2
SIGN_CH3	signal ramp of measuring chamber 3 –EZ150X1:C13–EZX31:7– 0...12V (24V out of range possible) differential signal with RF_0V_CH3
SIGN_CH4	signal ramp of measuring chamber 4 –EZ150X1:A13–EZX32:7– 0...12V (24V out of range possible) differential signal with RF_0V_CH4
SIGN_CH5	signal ramp of measuring chamber 5 –EZ150X1:C19–EZX41:7– 0...12V (24V out of range possible) differential signal with RF_0V_CH5
SL_CO_1	select correction 1 (thickness) –EWA100X1:A32–EWAX24:8– –EWB100X1:A32–EWBX24:8–
SL_CO_2	select correction 2 (thickness) –EWA100X1:C32–EWAX24:9– –EWB100X1:C32–EWBX24:9–
SL_CO_3	select correction 3 (density) –EWAX24:6– –EWBX24:6–
SL_CO_4	select correction 4 (density) –EWAX24:7– –EWBX24:7–
SL_PG_1	select ext APRT program 1 –EWA100X1:A28–EWAX23:1– –EWB100X1:A28–EWBX23:1–
SL_PG_2	select ext APRT program 2 –EWA100X1:C28–EWAX23:2– –EWB100X1:C28–EWBX23:2–
SL_PG_3	select ext APRT program 3 –EWA100X1:A29–EWAX23:3– –EWB100X1:A29–EWBX23:3–
SL_PG_4	select ext APRT program 4 –EWA100X1:C29–EWAX23:4– –EWB100X1:C29–EWBX23:4–
SL_PG_5	select ext APRT program 5 –EWA100X1:A30–EWAX23:5– –EWB100X1:A30–EWBX23:5–

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SL_PG_6	select ext APRT program 6 –EWA100X1:C30–EWAX23:6– –EWB100X1:C30–EWBX23:6–
SL_PG_7	select ext APRT program 7 –EWA100X1:A31–EWAX23:7– –EWB100X1:A31–EWBX23:7–
SL_PG_8	select ext APRT program 8 –EWA100X1:C31–EWAX23:8– –EWB100X1:C31–EWBX23:8–
SL_TO_TM_1	select tomo time 1 –EWA100X1:A24–EWAX21:1–
SL_TO_TM_2	select tomo time 2 –EWA100X1:C24–EWAX21:2–
SL_TO_TM_3	select tomo time 3 –EWA100X1:A25–EWAX21:3–
SL_TO_TM_4	select tomo time 4 –EWA100X1:C25–EWAX21:4–
SL_TO_TM_5	select tomo time 5 –EWA100X1:A26–EWAX21:5–
SL_TO_TM_6	select tomo time 6 –EWA100X1:C26–EWAX21:6–
SL_TO_TM_7	select tomo time 7 –EWA100X1:A27–EWAX21:7–
SL_TO_TM_8	select tomo time 8 –EWA100X1:C27–EWAX21:8–
SL_XG_TO	select X–ray generator for tomography –EWA100X1:C18–EWAX11:2–EWAX12:2–
STOP_X_C/	stop X–Ray command, X–ray off from FU –EZ119X2:A7–EZ130X2:A7–EZ139X2:A7–EZ150X2:A7–EZX52:4–EZX75– 0V/5V measuring point EZX75 inactivates CTRL_X_C/ EXOF exposure off command part of: XS/XRG bus
STU	stator line U –EYAX2:2(low speed)– –EY100X6:2(high speed)– part of: low/high speed rotor control
STV	stator line V = common –EYAX2:3(low speed)– –EY100X6:3(high speed)– part of: low/high speed rotor control

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STW	stator line W –EYAX2:4(low speed)– –EY100X6:4(high speed)– part of: low/high speed rotor control
SW_BU_1	switch bucky 1 (EWA or EWB) or 3 (EWB) –EWA100C1:C19–EWAX12:10– –EWB100X1:C19–EWBX12:10– part of: bucky ready contact
SW_BU_2	switch bucky 2 (EWA or EWB) or 4 (EWB) –EWA100X1:A21–EWAX12:10– –EWB100X1:A21–EWBX12:10– part of: bucky ready contact
SW_OF_FD_1	switch off measuring field 1 –EWB100X1:C21–EWBX13:5– cone contact
SW_ON_FD_3	switch on measuring field 3 –EWB100X1:A22–EWBX13:7–
SW_SF_CF_1	switch side field to central field bucky measuring chamber 1 (EWA or EWB) or 3 (EWB) –EWA100X1:A18–EWAX11:1– –EWB100X1:A18–EWBX11:1–
SW_SF_CF_2	switch side field to central field bucky measuring chamber 2 (EWA or EWB) or 4 (EWB) –EWA100X1:A20–EWAX12:1– –EWB100X1:A20–EWBX12:1–
SW_TO_1	switch tomography 1 –EWA100X1:A19–EWAX11:5– part of: tomo ready contact
SW_TO_2	switch tomography 2 –EWA100X1:C20–EWAX12:5– part of: tomo ready contact
SW_UN_EX	radiation indication –EZ150X1:A29–EZX1:4–
TB_2	tube 2 selected –EZ130X1:A13–EZX11:2– 0V/15V, low active
TB_2_RT	tube 2 selection check –EZ130X1:A10–EZX11:3– 0V/5V, low active
TB_3	tube 3 selected –EZ130X1:C13–EZX11:5– 0V/15V, low active
TB_3_RT	tube 3 selection check –EZ130X1:C10–EZX11:6– 0V/5V, low active

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TB_CU_FR_NG	tube current frequency negative –EZ119X1:B32–EZ119X1:Z32–EZX35:14–EG106X14:14– –15 V against ground
TB_CU_FR_PO	tube current frequency positive –EZ119X1:B30–EZ119X1:Z30–EZX35:6–EG106X16:6– 15V against ground, frequency: 1 kHz ≙ 2 mA, 0...1500mA 500kHz/A V against gro
TH_OL	tube housing overload –EZ130X1:A12–EZX3:6– 0...5V
TH_OL_SW/	tube housing overload switch –EZ130X1:A11–EZX3:3– 0V/26V, low active
TO_MO_PG	tomo mode programmed –EWA100X1:A17–EWAX22:9–
TO_PG_1	tomo program 1 –EWA100X1:A13–EWAX22:1–
TO_PG_2	tomo program 2 –EWA100X1:C13–EWAX22:2–
TO_PG_3	tomo program 3 –EWA100X1:A14–EWAX22:3–
TO_PG_4	tomo program 4 –EWA100X1:C14–EWAX22:4–
TO_PG_5	tomo program 5 –EWA100X1:A15–EWAX22:5–
TO_PG_6	tomo program 6 –EWA100X1:C15–EWAX22:6–
TO_PG_7	tomo program 7 –EWA100X1:A16–EWAX22:7–
TO_PG_8	tomo program 8 –EWA100X1:C16–EWAX22:8–
TO_PG_SL	tomo program selected –EWA100X1:C17–EWAX22:10–
TP_HT_GND	temperature high tension tank ground –EZ130X1:A19–EZX35:12–EG106X14:4–

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TP_HT_SG	temperature signal high tension tank –EZ130X1:C19–EZX35:4–EG106X14:12– 0...5V +25 °C(12kΩ)...+100 °C(950 Ω)
TT_PO_1/	table top position 1 –EWB100X1:A24–EWBX22:1– part of: angio
TT_PO_2/	table top position 2 –EWB100X1:C24–EWBX22:2– part of: angio
TT_PO_3/	table top position 3 –EWB100X1:A25–EWBX22:3– part of: angio
TT_PO_4/	table top position 4 –EWB100X1:C25–EWBX22:4– part of: angio
TT_PO_5/	table top position 5 –EWB100X1:A26–EWBX22:5– part of: angio
TT_PO_6/	table top position 6 –EWB100X1:C26–EWBX22:7– part of: angio
TT_PO_7/	table top position 7 –EWB100X1:A27–EWBX22:8– part of: angio
TT_PO_8/	table top position 8 –EWB100X1:C27–EWBX22:10– part of: angio
V15C	system CAN + 15 V supply –EZ139X1:A17–EZX42:9–EZX43:9–EZX44:4– min.+11.5V nom+15V max.+16V Vcan part of: system CAN
V15S	signal bus + 15V supply –EZ139X1:A6–EZ139X1:C6–EZX23:13–EZX23:25–EZX44:5–EZX45:7–EWAX51:7–EWAX52:7–EWA100X2:A27– EWA100X2:C27–EWBX51:7–EWAX52:7–EWB100X2:A27–EWB100X2:C27– min.+14.2V nom+15V max.+16V Vsgn part of: signal bus
V24_DSR	COM1 data set ready EZ139X5:6 part of: service interface

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V24_DTR	COM1 data terminal ready EZ139X5:4 part of: service interface
V24_RxD/	COM1 serial data input EZ139X5:2 part of: service interface
V24_TxD/	COM1 serial data output EZ139X5:3 part of: service interface
VO_CR_IF_0	voltage correction dependent on II format 0 = 10" or 5" –EWB100X1:C22–EWBX13:3–EWBX14:1– 5"/10" II format
VO_CR_IF_1	voltage correction dependent on II format 1 = 6" –EWB100X1:A23–EWBX14:2– 6" II format
VO_CR_IF_3	voltage correction dependent on II format 3 = 14" –EWB100X1:C23–EWBX14:3– 14" II format
X_ACT/	signal bus X–ray active –EZ139X1:A5–EZX23:5–EZX45:6–EWAX51:6–EWAX52:6–EWA100X2:C24– –EWBX51:6–EWBX52:6–EWB100X2:C24– driven by CU, X_ACT_S/ status dependent, old: EXON signal part of: signal bus 0V/15V
X_ACT_S/	X–Ray active signal, kV > 75% nominal value or 'fluoroscopy technique' high tension on –EZ119X2:A8–EZ130X2:A8–EZ139X2:A8–EZ150X2:A8–EZX52:5–EZX77– 0V/5V measuring point EZX77 HTON (high tension on) or FLON (fluoroscopy high tension on) signal part of: XS/XRG bus, controls X_ACT/ status
XG_RD_EX_1	X–ray generator ready for exposure request –EWA100X1:C3–EWAX1:2– –EWB100X1:C3–EWBX1:2–
XG_RD_EX_2	X–ray generator ready for exposure request –EWA100X1:A6–EWAX2:2– –EWB100X1:A6–EWBX2:2–
XG_RD_EX_3	X–ray generator ready for exposure request –EWA100X1:A8–EWAX3:2– –EWB100X1:A8–EWBX3:2–
XG_RD_EX_4	X–ray generator ready for exposure request –EWA100X1:A10–EWAX4:2– –EWB100X1:A10–EWBX4:2–

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10. Function unit kV

Switch–on not possible:

– ENF1 released.

– ENF1 not switched on (visual check).

– ENF2 released by low–voltage supply
filament circuit
tube extension
external components supply.

– FNF2 not switched on (visual check).

– "ON" circuit EN100 defective.

Phase supervision

a) Without mains adaptation transformer:

– Phase L1 is missing: Mains contactors ENK2 and ENK1 cannot be activated.

– Phase L2 is missing: The generator can be switched on but does not go into the READY state.
The filament–circuit supply is missing.
There is an error message from function unit kV.

– Phase L3 is missing: "ON" circuit without supply voltage.

Fault tracing:

Check leads and fuses up to the mains supply.

b) With mains adaptation transformer:
In case at least one phase at the primary end is missing, the generator cannot be switched on. If there is a problem concerning the leads at the secondary end, refer to a).

After switch–on or attempted switch–on:

The generator cannot be brought into the READY state (e.g. no desk display).

Check the low–voltage supply.

– ENF1 released:
Ground fault/short–circuit of one/several phase(s).
Check ENK2 and, if necessary, the contacts of ENK1.
Check the leads and the mains adaptation transformer.
Have contacts ENK2 or ENK1 dropped out?
Check visually. Be careful when doing so since the unit is still connected to mains.

– Missing voltage of intermediate circuit:
The damping resistors are unsoldered which was caused by overcurrent during switch–on.
Cause: Short–circuit in the converter, defective charging capacitors, mains–filter capacitors or rectifiers.

The damping resistors are unsoldered because the converter was active and ENK1 was not switched on although activated by the software.
Probably termination of exposure.

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This procedure can only happen once since the generator cannot go into STANDBY when intermediate–circuit voltage E is missing.

In case intermediate–circuit voltage E is present, ENK1 is activated by the software of the kV–control and remains activated for the complete time the unit is in operation.

In case of high impedance or when the tolerance of the symmetry resistors of the intermediate–circuit capacitor battery is too large, capacitors may be destroyed by overvoltage. In case ENK1 has already been activated, ENF1 will probably release.

ENF3 is released by the rotor control units.

The release of ENF2 switches the generator off since the supply voltage for the "ON" circuit and, consequently, the supply voltage of contactors ENK2 and ENK1 is interrupted.

Converter

Resonant capacitor(s) defective:

- At least one of the two capacitors is ineffective:
  High voltage is not possible with the 50 kW version.
  Asymmetry or too low kV with the 65/80/100 kV versions.
- Short circuit on one of the two capacitors (in case both capacitors are concerned, ENF1 will be released):
  Low resonant–circuit frequency.
  The IGTBs can break because of overcurrent.
  Overvoltage at the resonant capacitor which is intact.
  kV overswing.
  DC short–circuit current possible because of resonant current which has not yet died off.

Snubber diode on kV power board defective:

- High impedance:
  IGBTs defective. DC short–circuit current causes the release of ENF1.
- Short circuit:
  IGBTs defective. DC short–circuit current causes the release of ENF1. The resistors of the protective wiring might be destroyed in advance.

The fan for the IGBT heat sinks fails:
The temperature is measured and a (warning) message is given via the software.
The converter is switched off when the limit values are exceeded (error).
This might be caused by failure of the +26 V/+15 V supply of the fan.

The NTC resistor for temperature measurement is supervised via the software with respect to logical values.
The valid temperature range is between these error conditions.

Open/shorted measuring circuits or any values going beyond the temperature limits will cause an error message.

In case of short circuit in the measuring circuit the fan motor runs continuously.

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11. Functional description of function unit mA

Tube data of Philips products must be loaded as a data set from floppy disk via PC and central unit CU to into function unit mA.

In case non–Philips products are concerned, the tube data must be entered manually before tube adaptation can successfully be carried out.

The procedures described below cannot be carried out before the complete data set for the tube housing assembly is present in central unit CU.

Before the tube adaptation can be started, tube conditioning must be implemented.

With the present generator release the conditioning must be implemented manually.

Later on the conditioning program will take place automatically.

Before adaptation can be started, the mA offset value of the mA measuring circuit must be determined.

This offset value consists of two components:

1. A current of 4 mA is impressed upon the mA measuring circuit which is used for continuous calibration (during STANDBY about once per minute).
2. In addition to this the kV measuring circuit delivers an offset current depending on the kV.

To measure this total value an exposure must be released with 40 kV without filament current. The current measured is the correction value for all standard exposures (4 mA, measuring circuit current depending on the kV).

As opposed to the standby filament current value of the predecessor versions of the generator, the standby filament current value of the OPTIMUS generator is not fixed.

It is determined for each focus individually. A 40 kV exposure must be released with the focus to be measured while all other foci are switched off.

The filament current must be changed until an emission current of 100 µA is obtained.

The associated filament current value is the individual standby filament current (1% to be substracted so that the fluoroscopic current of any of the other foci is not affected).

The adaptation program takes place fully automatically.

Based on 120 single exposures for each focus a data field is created in the CMOS of function unit mA. The adjustments for all other exposures are interpolated from this data field during operation.

During the adaptation procedure any limit values such as maximum filament current, maximum kV, maximum tube load, maximum output, current of the generator etc. are taken into account.

Boost adaptation

Boost time determination (positive boosting).

With the predecessor versions of the generator, a **calculated boost current** was added to the exposure filament current for a **fixed time** of 400 ms.

With OPTIMUS generators the boost current is also fixed but with a **variable time**.

The amount of the boost current is the sum of the maximum filament current (of the respective filament) plus 2000 mA.

To determine the time values an exposure must be started in the kV isowatt point (determined from tube and generator parameters).

As soon as the 100% kV value is reached, the maximum filament current plus 2000 mA is adjusted by function unit mA. The emission current is measured every 2 ms until the maximum tube current or the maximum possible generator current is reached.

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In case this procedure takes too long (warming up of the tube), the measurement is continued with a second exposure after a sufficient period of time has passed.

The measurement starts again at the value obtained last.

An innovation of the OPTIMUS generator is the determination of the **negative boosting** (blanking of the filament current).

The measurement is started with the same kV isowatt exposure which is used for the determination of the positive boost time but with maximum filament current.

As soon as the 100% kV value is reached, the maximum filament current of the filament circuit is abruptly reduced to 500 mA.

Every 2 ms the emission current is measured until a value of 100 µA is obtained.

The values for the blanking times are required for techniques such as, for instance, cine.

A filament current value of 500 m must not be exceeded for otherwise the output to supply a gridswitch box (which might be present) is too low.

The following procedure takes place after the generator has been switched on:

Function unit mA initializes itself and afterwards establishes connection with central unit CU via CAN.

For 3 seconds all foci are boosted with their respective specified maximum filament current. Then blanking of the filament current (500 mA) takes place for a variable period of time (derrived from negative boost adaptation) to bring the filament current to the STANDBY value.

The change of the filament current value upon a change of the focus which was the usual routine for the predecessor versions of the OPTIMUS generator does no longer take place – all STANDBY values remain constant.

During operation the following procedure takes place after the release of PREP:

– The filament current is raised from the individual STANDBY filament current which depends on the focus to the boost current.

The switch–on time of the boost current results from the difference between STANDBY and intermediate filament current.

- The intermediate filament current is a calculated value. It is calculated in such a way that the filament current and thus the filament temperature is brought to exposure level when the boost current is switched off for 50 ms directly at the end of the preparation phase (RQ_SN_X/ already active) and/or directly before high voltage is switched on (RQ_SN_X/ active when the patient is quiet).
- During exposure the filament current is regulated as required.
- At the end of exposure the filament current is reduced to the minimum value of 500 mA (negative boosting) for a short time.

  At the same time the temperature of the filament abruptly drops to a level which corresponds to the level of the intermediate filament current.

  Afterwards heating takes place with the intermediate filament current.

  Now the tube would be ready for the next exposure with the same preparation.
- In case preparation is released, negative boosting takes place until heating can go on with the STANDBY filament current.

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Central rack,
service aid

A2/A4 94-07-04 Schr./Ost.
u00637

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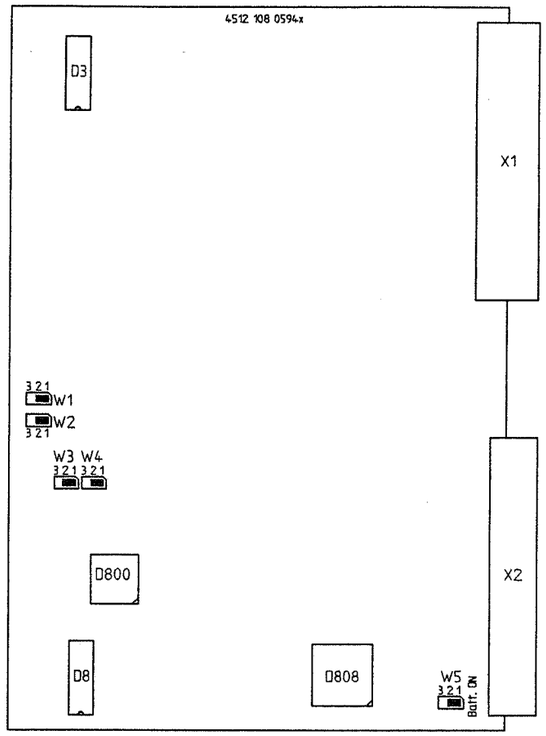
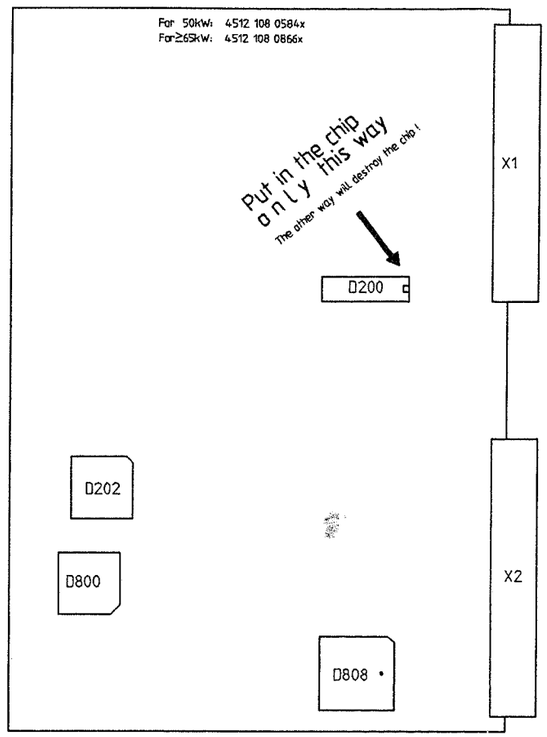
EZ 119 mA control



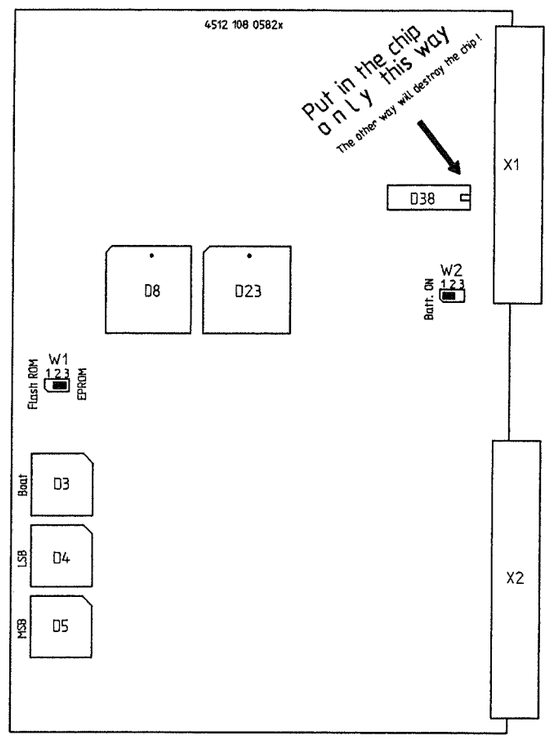
D3 = 4512 113 18091
D8 = 18081
D800 = 20201/2
D808 = 18061

EZ 130 kV control (50kW)/ kV control 2 (≥65kW)



	kV control (50kW)	kV control 2 (≥65kW)
D200 =	4512 113 18111	18111
D202 =	18121	18121
D800 =	20101	20111
D808 =	18061	18061

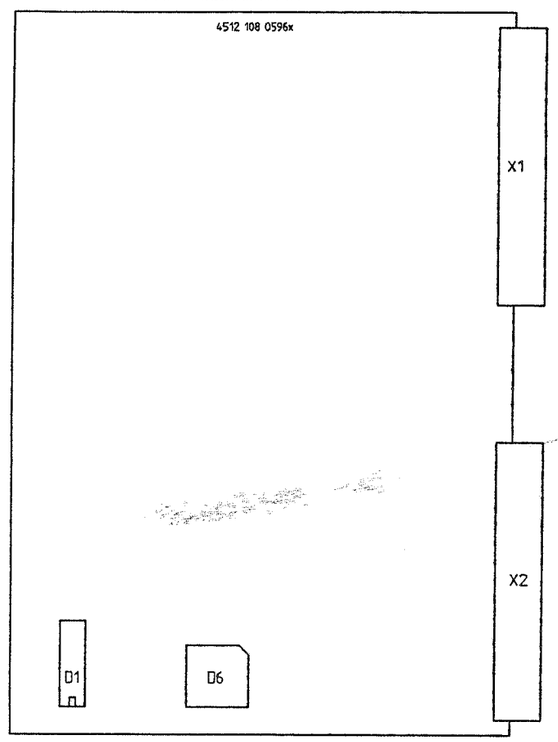
EZ 139 Central unit



D3 = 4512 113 20702
D8 = 18041
D23 = 18051
D38 = function key, marked with s/n of the generator

		Rel. 0.2	Rel. 0.3
D4 =	4512 113	18022	18023
D5 =		18032	18033

EZ 150 Basic interface



D1 = 4512 113 18071
D6 = 20301

A1/A3 94-12-09 Schr./Ost.
u00636

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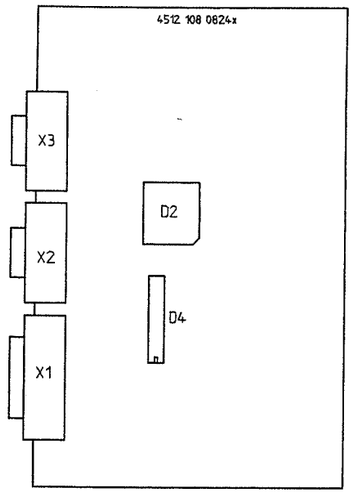
PCB programming central rack EZ

Operating desk C

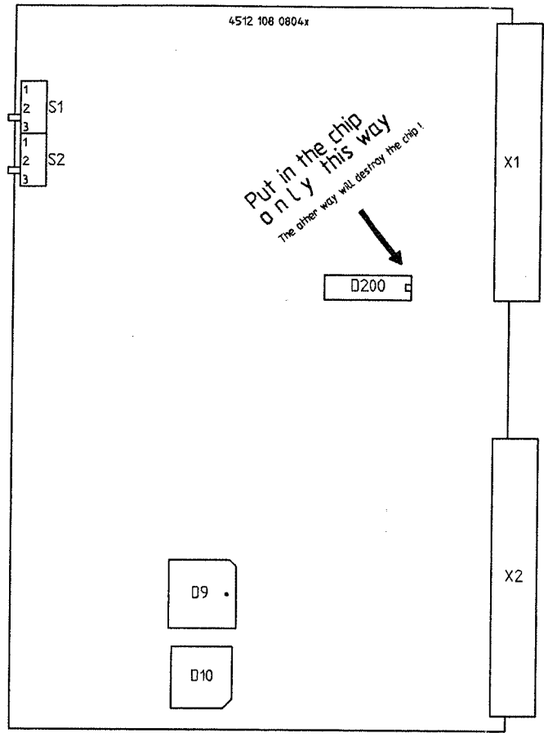
C 300 CPU



D2 = 4512 113 20502
D4 = 18071

Adapter decade cable WA, 1WA, 2WA

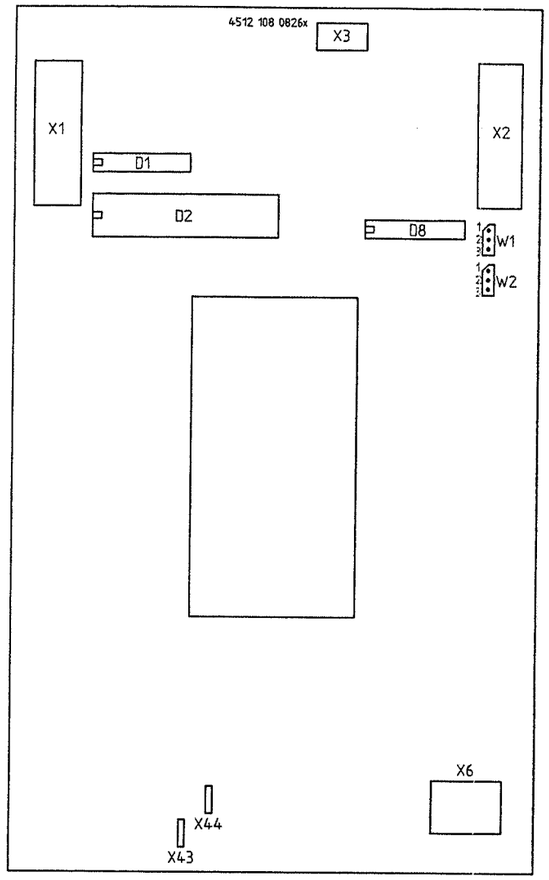
WA 102 Universal I/O interface



D9 = 4512 113 18201
D10 = 20601

High speed rotor control Y

Y 100 Roco HS



Coding	Rotor control 1st	2nd	3rd
W1	1 2 3		
W2	1 2 3		

D1 = 4512 113 18071
D2 = 20401
D8 = 18101

A1/A3 94-12-09 Schr./Ost.
u00647

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ACCEPTANCE

Contents 7–0.1

1. **Preface** 7–1
2. **Test equipment** 7–1
3. **Setup** 7–1
4. **Test** 7–2

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1. Preface

OPTIMUS generators are factory–calibrated and checked for compliance with the parameter readout tolerances as stated in the relevant Operator's Manuals.

Provided these generators are installed and set to work in accordance with the Installation Manuals only the following limited field compliance testing is required.

2. Test equipment

- Keithley voltage divider model No. 35080 with filter packs 32867C, 5C, 9C or equivalent.
- Oscilloscope (storage)
- Digital mA, mAs meter.

Notes

Do not start test until generator has been switched on for at least one hour.

Direct (invasive) kVp measurements on OPTIMUS generators with HV divider tanks normally available to the field service organization are not permitted.

3. Setup

- Switch off generator and also switch off main disconnect breaker to system.
- Connect digital mA meter as per instructions in the relevant Service Manual.
- Set up the Keithley voltage divider complete with the appropriate filter as per Keithley Instructions Manual No. 3294 OIM.
- Connect the oscilloscope to the Keithley divider.

Note

Make sure that the oscilloscope has been calibrated with the aid of the Keithley divider as described in the Keithley Instructions Manual before starting any testing (par. 3.6. Internal calibration).

- Calculate rejection limits based on the exposure parameter "Specification Limits" shown in the table below.

  The "Specification Limits" are based on the actual tolerances as listed in the generator Operator's Manuals. These "Specification Limits" must be restricted to include the actual measuring instrument error. See also section 6, par. 3.1. of "Comprehensive Compliance Testing Manual" No. 4535 800 2034. regarding how to calculate rejection limits.

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4. Test

- Switch the system on.
- Measure the mains voltage on ENF1.

  Reference voltage: Mains voltage programmed ± 10%

  Actual values: L1 – L2: V

  L1 – L3: V

  L2 – L3: V

- Select the largest focus.
- Release exposures according to the table below and compare the values measured with the reference values.

Technique	Parameter	Reference range	Actual value
3–knob technique	81 kV	77 ... 85 kV	..... kV
	250 mA	237 ... 263 mA	..... mA
	100 ms	94.5 ... 105.5 ms	..... ms
2–knob technique	125 kV	121 ... 129 kV	..... kV
	80 mAs	77.1 ... 82.9 mAs	..... mAs

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Service Information Checklist

Equipment :
Artikel : _____ Type No. : _____

_____ Serial No. :
Fabrik-Nr. : _____

Installation Date :
_____ Montage-Datum : _____

N-Sheet No. Service - Information Nr.	Implemented / Durchgeführt		Remarks / Bemerkungen
	Date / Datum	Signature / Unterschrift	

N-Sheet No. / Service-Information Nr.	Implemented / Durchgeführt		Remarks / Bemerkungen
	Date / Datum	Signature / Unterschrift	

Drawings
Schematic diagrams

File: OPTIMUS.Z0-94.1

Basis

Block diagram basis	Z1- 1.1
Block diagram expansions	Z1- 1.2
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Power supply with mains transformer	Z1- 2.2
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kV power unit	Z1- 3.2
kV-control	Z1- 3.3
mA control	Z1- 4.1
H.V.generator	Z1- 4.2
Central unit	Z1- 5.1
Basic interface	Z1- 6

Options

Operating panel C	Z1-11.1
Button and display arrangement	Z1-11.2
Low speed rotor control	Z1-12
High speed rotor control	Z1-13.2
Tube extension overview	Z1-14.1
Tube extension WG/1WG/2WG	Z1-14.2
Adaptor 4 auxil.units WA/1WA/2WA	Z1-15.1

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Function units CU and DRC
(Z1-5)

Power supply
(Z1-2)

Function unit kV
(Z1-3)

Function unit mA_a
(Z1-4)

Function unit CIE
(Z1-6)

Service PC — X5

EZ139
Central unit CU
Dose rate control DRC

EZX61
DRC input — X1

X1/X2 X1/X2

EZ102
Low voltage supply

X1 X2

5V
-15V
+15V
26V

EZ130
kV Control

X1 X2 X1 X1

EZ119
mA Control

X1 X1 X1/X2

Room decade | Cooling unit | Measuring chamber 1 2 3 4 5

EZ X1 | EZ X2 | EZ X21 | EZ X22 | EZ X31 | EZ X32 | EZ X41

EZ150
Basic interface

X1 X1 X1

X1/X2

External signal bus — EZX23 — XS bus
System control
System CAN — EZX42 EZX43* — CAN
Function programming plug
- system control
- desk control
EZX44
XS bus
XRG bus

XS-bus — External XS-bus + internal CAN — EZX45
XRG-bus
Internal CAN/XS-bus — EZX52*
Internal expansion

EZX47 — EN100X1
EZX46

26V 230V~ 26V

EZX5 EZX20 EZX13 EZX17 EZX18 EZX19
Decade cable adapter (option)

EZX34 EZX24

EZX35 EZX12 EZX3 EZX51

300X1
C
Operating panel
200X1
300X2 — Printer

Function unit HI_a

100X1
100X2
E2Q
2nd power unit for P≥ 6.5kW
100X1
100X2
EQ
Power unit

X14 X15
EG
H.V. generator
X1000
X1000

100X1
EYA
Rotor control LS or HS (low or high speed)
3~400V

Function unit RC_a

stator supply

supervision
Tube

H.V. cables

EZX47
EZX41
Emergency OFF
EZX42

F3
100X1
K1
3~400...480V
X1100
X1100

Mains
3 ~ 400...480V
50/60Hz
F1
EN
Power supply
F2/K2
F3

EZX14 — 230V~ — 2nd low voltage supply (option)
EZX15 — 230V~ — tube extension (option)
230V~ — stand
3~400V — rotor control LS/HS

Remark:
* When not used CAN connections EZX43 and EZX52 must be provided with a termination resistor.

Block diagram
Basis

Z1-1.1

A1/A3 94-12-01 Ost.
v00252

OPTIMUS (94.1)

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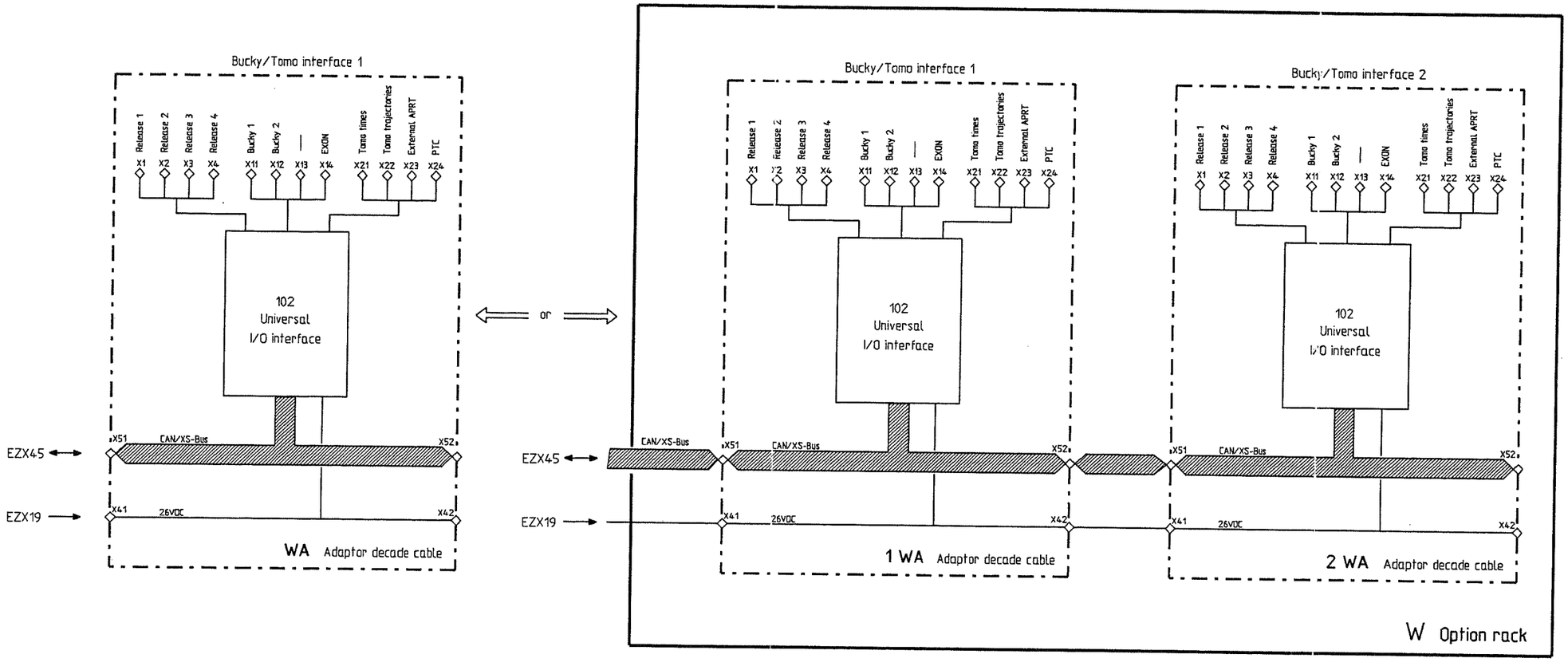
Function unit ADAP_a

Function unit ADAP_a

Function unit ADAP_b

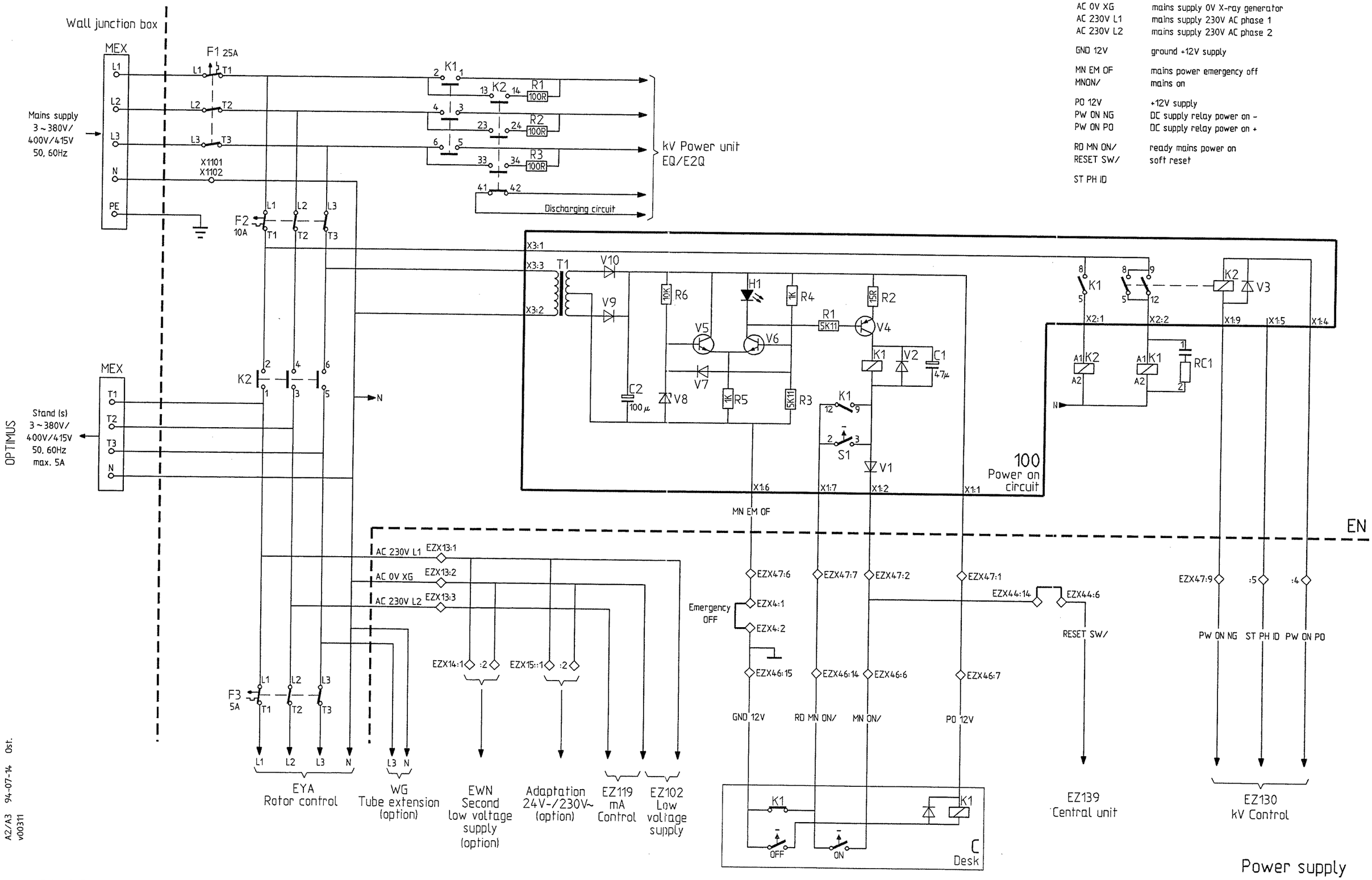


A1/A3 94-10-24 Schr./Ost.
u00615

Block diagram
Expansions

Mnemonic's

AC 0V XG	mains supply 0V X-ray generator
AC 230V L1	mains supply 230V AC phase 1
AC 230V L2	mains supply 230V AC phase 2
GND 12V	ground +12V supply
MN EM OF	mains power emergency off
MNON/	mains on
PO 12V	+12V supply
PW ON NG	DC supply relay power on -
PW ON PO	DC supply relay power on +
RD MN ON/	ready mains power on
RESET SW/	soft reset
ST PH ID	



Power supply

Z1-2.1

A2/A3 94-07-14 Ost.
v00311

OPTIMUS (94.0)

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Mnemonic's

AC 0V XG	mains supply 0V X-ray generator
AC 230V L1	mains supply 230V AC phase 1
AC 230V L2	mains supply 230V AC phase 2
GND 12V	ground +12V supply
MN EM OF	mains power emergency off
MNON/	mains on
PO 12V	+12V supply
PW ON NG	DC supply relay power on -
PW ON PO	DC supply relay power on +
RD MN ON/	ready mains power on
RESET SW/	soft reset
SI PH ID	single phase identifier

Wall junction box

Mains supply
3~ 380V...480V
50, 60Hz

MEX
L1
L2
L3
N
PE

F1 25A

TX 1101 ..02 ..03 480V
..04 ..05 ..06 460V
..07 ..08 ..09 440V
..10 ..11 ..12 400V

Connected according to mains voltage.

K1 K2 R1 100R
R2 100R
R3 100R

kV Power unit
EQ/E2Q

Discharging circuit

T

t
Thermo fuse

TX1201 ..02 ..03 ..04
L1 L2 L3
F2 10A
T1 T2 T3
X1101
X1102

OPTIMUS

MEX
T1
T2
T3
N

Stand (s)
3~380/400V
50, 60Hz
max. 5A

K2

N

X3:1
X3:3
X3:2
T1
V10
V9
10K R6
H1
1K R4
15R R2
R1 5K11
V4
V5
V6
K1
V2
C1 47µ
V7
C2 100µ
V8
1K R5
5K11 R3
K1
12 9
2 3
S1
V1
100
Power on circuit
X1:6
X1:7
X1:2
X1:1

8 8 9
K1 K2 V3
5 5 12
X2:1
X2:2
X1:9
X1:5
X1:4
TX1205
Thermo fuse
TX1206
A1 K2 A2
A1 K1 A2
RC1
1 2
N

MN EM OF
EN
EZX47:6
EZX47:7
EZX47:2
EZX47:1
EZX44:14
EZX44:6
RESET SW/
EZX47:9
:5
:4
PW ON NG
SI PH ID
PW ON PO
EZ139
Central unit
EZ130
kV Control

Emergency OFF
EZX4:1
EZX4:2
EZX46:15
EZX46:14
EZX46:6
EZX46:7
GND 12V
RD MN ON/
MN ON/
PO 12V

AC 230V L1 EZX13:1
AC 0V XG EZX13:2
AC 230V L2 EZX13:3

F3 5A
L1 L2 L3
T1 T2 T3
L1 L2 L3 N
L3 N

EZX14:1 :2
EZX15:1 :2

EYA
Rotor control
WG
Tube extension
(option)
EWN
Second
low voltage
supply
(option)
Adaptation
24V-/230V~
(option)
EZ119
mA
Control
EZ102
Low
voltage
supply

K1
OFF
ON
K1
Desk

A2/A3 94-08-22 Ost.
v00312

OPTIMUS
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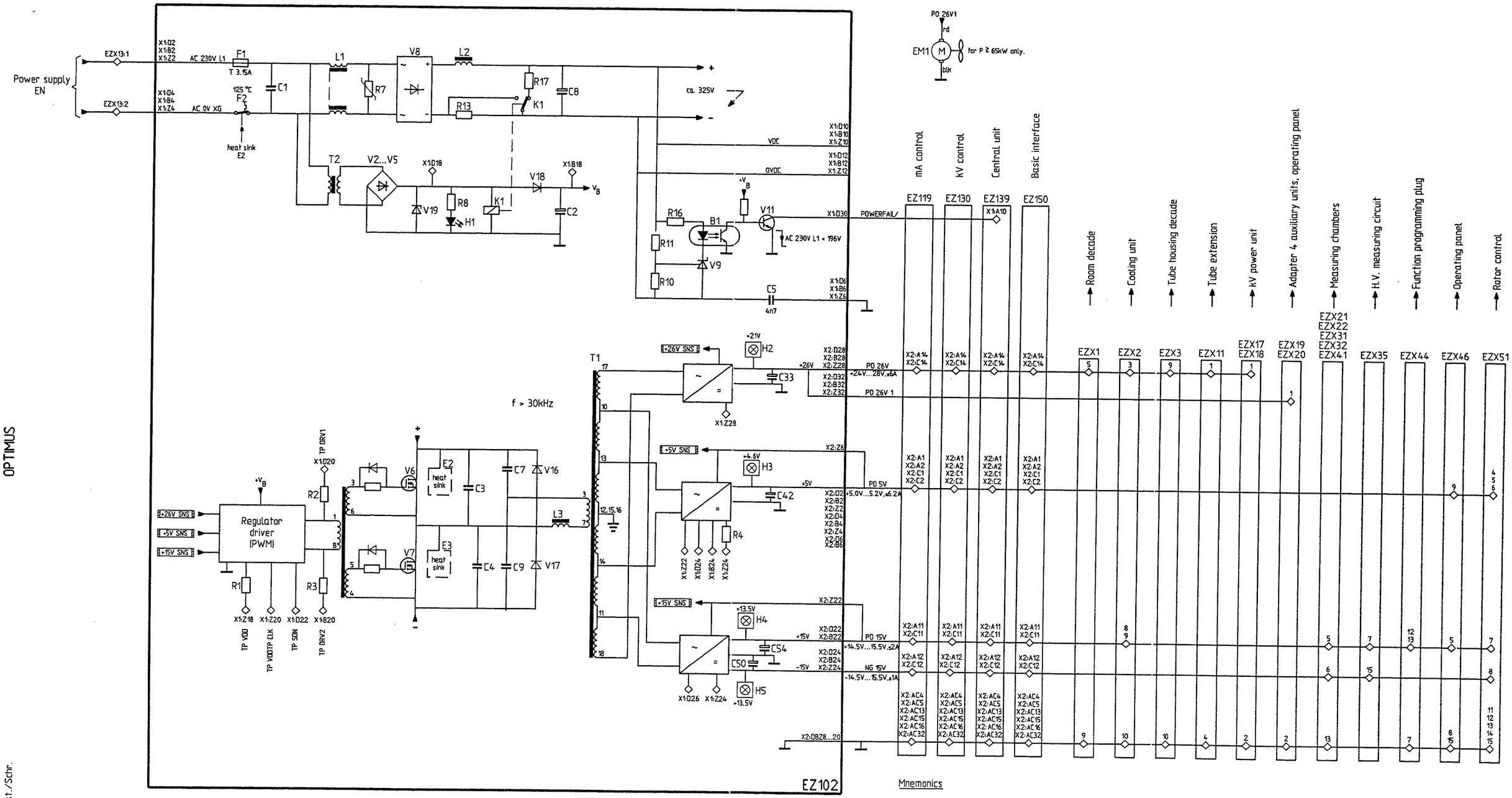
(94.1)

Power supply
with mains transformer

Z1-2.2



Mnemonics

0V DC	
+5V SNS	5V sense
+15V SNS	15V sense
+26V SNS	26V sense
AC 0V XG	mains supply 0V X-ray generator
AC 230V L1	mains supply 230V AC phase 1
NG 15V	-15V supply
PO 5V	+5V supply
PO 15V	+15V supply
PO 26V	+26V supply
PO 26V1	+26V supply optional
POWERFAI L/	power failure reset
TP CLK TP DRV1 TP DRV2 TP SDN TP VDD	test points for internal signals
VDC	

Low voltage power supply

Z1-2.3

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EZ130
kV control
EZX24
(EZX34)

T1
50kHz
galvanically decoupled
power supply for
drivers 1 and 2

driver 1
driver 2
driver 3
driver 4

I1-1 (I2-1)
I1-1/ (I2-1/)
I1-2 (I2-2)
I1-2/ (I2-2/)
I1-3 (I2-3)
I1-3/ (I2-3/)
I1-4 (I2-4)
I1-4/ (I2-4/)

X1:14 X1:1 X1:15 X1:2 X1:16 X1:3 X1:17 X1:4

R25 R26 R27 R28 R29 R30 R31 R32

A100 R100 R101 R102 R103 A101
A200 R200 R201 R202 R203 A201
A300 R300 R301 R302 R303 A301
A400 R400 R401 R402 R403 A401
+15V -15V 33R

X100 Gate 1
X101 Emitter 1
X200 Gate 2
X201 Emitter 2
X300 Gate 3
X301 Emitter 3
X400 Gate 4
X401 Emitter 4

T2
50kHz
galvanically decoupled
power supply for
drivers 3 and 4

Low voltage supply
EZ102

X2:1 X2:2
L1
C1 1µ C2 1µ C3 100µ C4 100µ
+26V
A1 LM317T
R1 121R R2 1K
C5 100µ
+12V
X3 rd
X4 blk
X5
X6
X7 gn
M1 blower
NTC 100k S2
heat sink for V1...V4

+480...750V

NN502 NN503 NN500 NN501 NN506 NN507 NN504 NN505

V1 Gate 1 Emitter 1
V2 Gate 2 Emitter 2
V3 Gate 3 Emitter 3
V4 Gate 4 Emitter 4
V500 V501 V502 V503

C504... C507 4x47n
C508... C511 4x47n
C512... C515 4x47n
C516... C519 4x47n
R508 R509 R510 R511 R512 R513 22R
R506 R507

C3 8µ C13 8µ

R501 200K R500 100K
R504 200K R505 100K
V33 V34 10K
R23 C18 4.7n
R24 C19 4.7n
X1:18 E PO
X1:05 E NG

X1:19 CV1 ID (CV2 ID)
X1:20 CV1 GND (CV2 GND)
X1:21 CV1 GND (CV2 GND)
X1:6 CV1 TM (CV2 TM)
X1:8 CV1 GND (CV2 GND)
X1:26
X1:27

R514 4K7 C500 22n
R515 4M7 C501 22n
C502 100n C503 100n
X504 X8 X9
heat sink for V1...V4

EZX24 (EZX34)
EZ130 kV control

100
kV power
4512 108 05882

EQ
(E2Q)

X1001 X1002 X1003 X1004
2K 100Ω 20K 5R kV mA X1
106
Measuring circuit

EG
H.V. generator

for P ≥ 65kW.
E2Q
or

Remarks

EQ = kV power unit for P ≤ 50 kW, mounted in the front of the generator.
E2Q = 2nd kV power unit for P ≤ 65 kW, mounted on the rear side of EQ.
(...) = any information in brackets is valid for E2Q.

Power supply
3~ 400 ... 480V
50, 60Hz
L1 X1101
L2 X1102
L3 X1103
L1 L2 V5

R11 4.7K C1 3300µ C11 3300µ
R1 4.7K C2 3300µ C12 3300µ
480 ... 750V

X1 X2 X3 X21 X22 X23 X12 X14
C1 C2 C3 C4 C5 C6 C7
R1 3M R3 3M R2 3M
R2 2K7 R1 2K7
X11 X13
NN1 X24
EMC filter 200
Not connected if P≥ 65kW.

Discharging of DC circuit after switch-off of generator
ENK2 41 42

Power supply
3~ 400 ... 480V
50, 60Hz
L1 L2 L3
E2Q

Mnemonics

E NG	E value converter DC supply negative
E PO	E value converter DC supply positive
CV1 GND	converter power part 1 ground
CV2 GND	" " " 2 "
CV1 ID	converter power part 1 identification
CV2 ID	" " " 2 "
CV1 TM	converter power part 1 temperature
CV2 TM	" " " 2 "
I1 1 / I1 1/	IGBT1 power part 1
I1 2 / I1 2/	IGBT2 power part 1
I1 3 / I1 3/	IGBT3 power part 1
I1 4 / I1 4/	IGBT4 power part 1
I2 1 / I2 1/	IGBT1 power part 2
I2 2 / I2 2/	IGBT2 power part 2
I2 3 / I2 3/	IGBT3 power part 2
I2 4 / I2 4/	IGBT4 power part 2

A1/A3 95-05-11 Ost.
V00274

OPTIMUS
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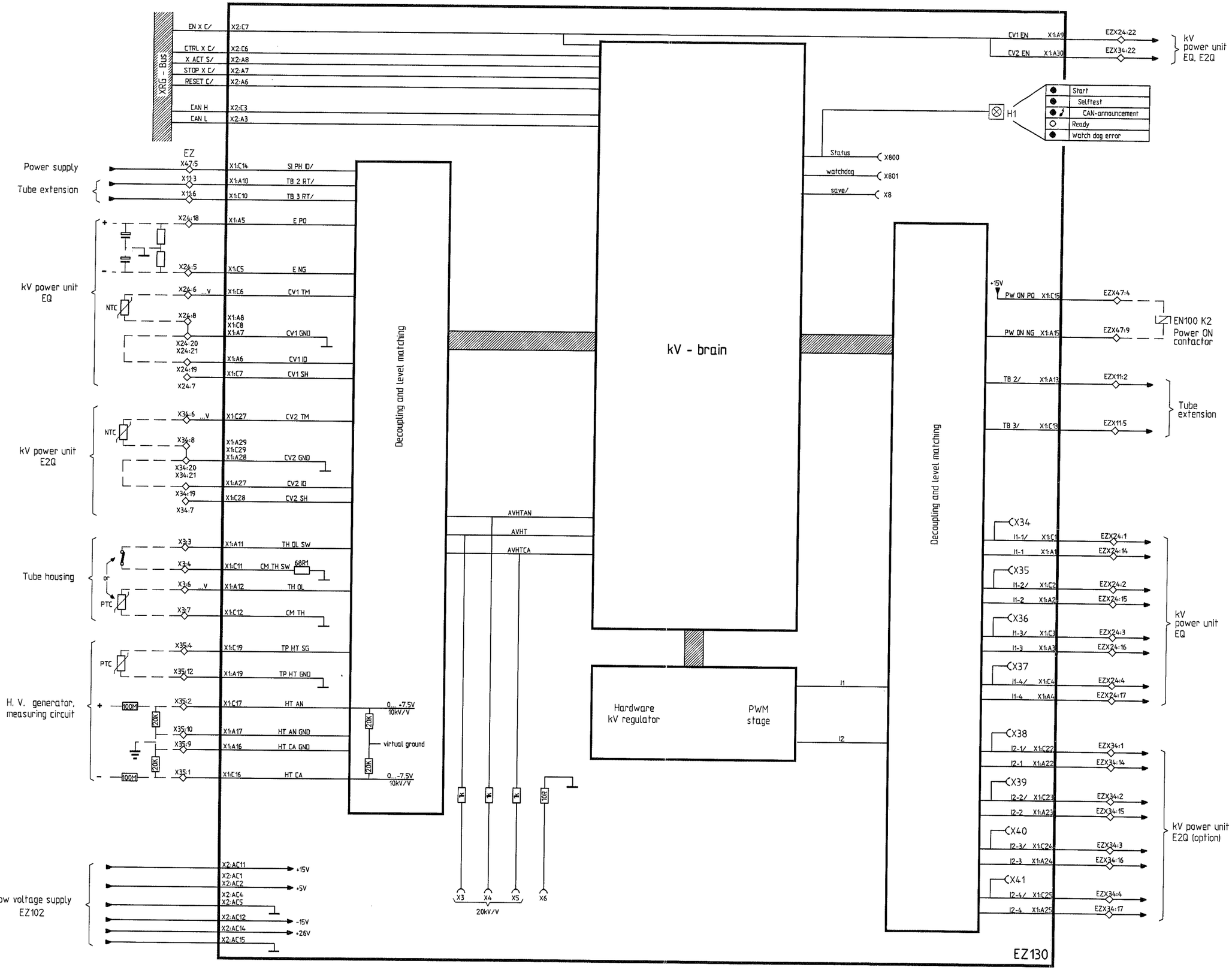
(95.0)

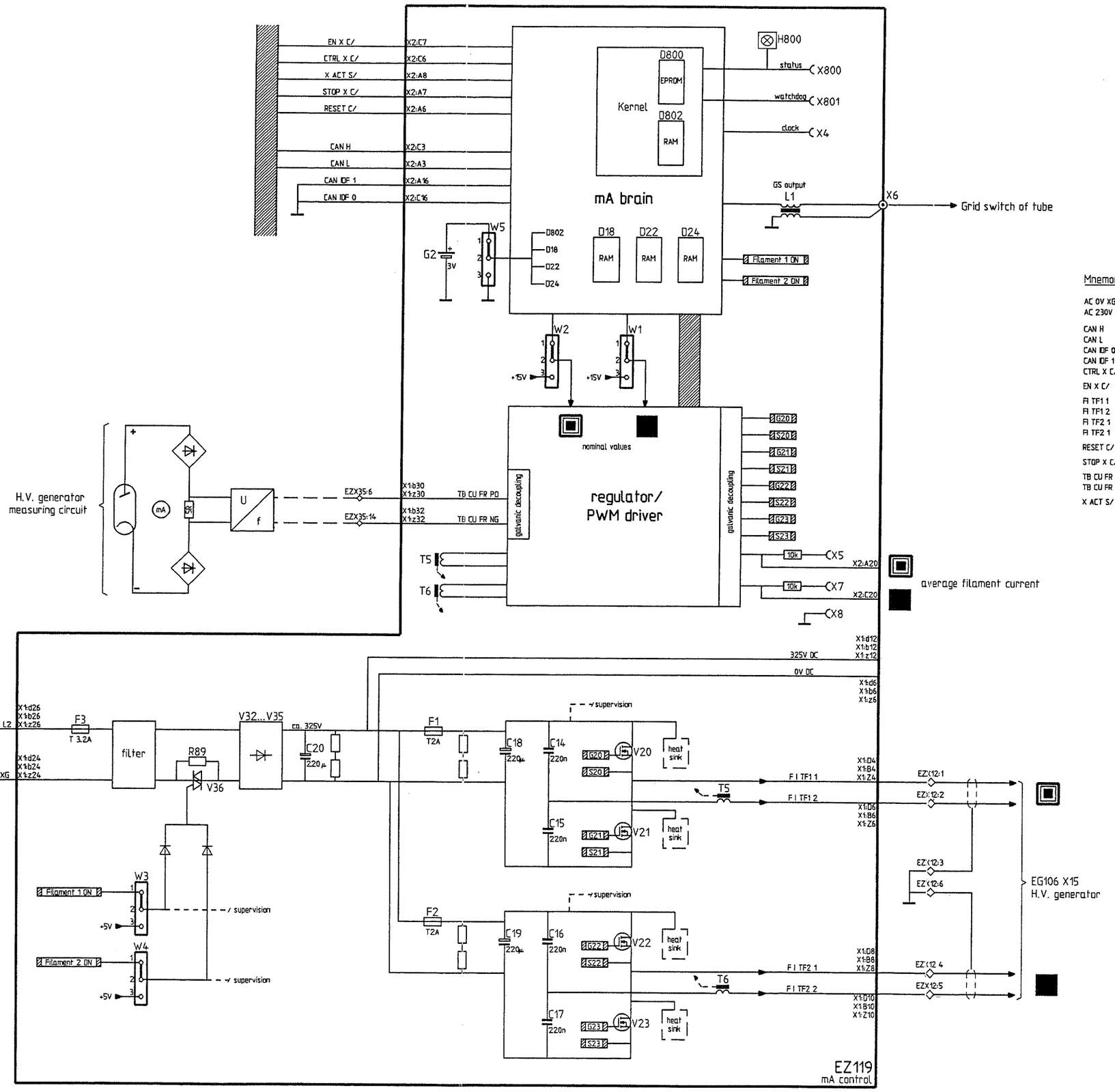
kV power unit

Z1-3.2



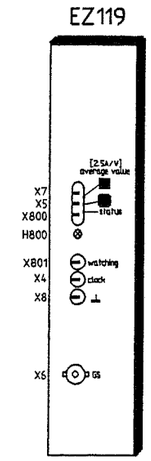
Mnemonics

AV HT	high tension actual value
AV HT AN	high tension actual value anode side
AV CT CA	high tension actual value cathode side
CAN H	generator CAN high active
CAN L	generator CAN low active
CM TH	common for thermal sensor
CM TH SW	common for tube housing switch
CTRL X C/	control X-ray command
CV1 EN	converter power part 1 enable
CV2 EN	" " " 2 "
CV1 GND	converter power part 1 ground
CV2 GND	" " " 2 "
CV1 ID	converter power part 1 identification
CV2 ID	" 2
CV1 GND OL	converter power part 1 ground overload
CV2 GND OL	" " " 2 " "
CV1 SH	converter power part 1 temperature shield
CV2 SH	" " " 2 " "
CV1 TM	converter power part 1 temperature
CV2 TM	" " " 2 "
E NG	E value converter DC supply negative
E PO	E value converter DC supply positive
EN X C/	enable X-ray command
HT AN	high tension anode side actual value
HT AN GND	high tension anode side ground
HT CA	high tension cathode side actual value
HT CA GND	high tension cathode side ground
I1	power part 1
I2	power part 2
I1-1 I1-1/	IGBT1 power part 1
I1-2 I1-2/	IGBT2 power part 1
I1-3 I1-3/	IGBT3 power part 1
I1-4 I1-4/	IGBT4 power part 1
I2-1 I2-1/	IGBT1 power part 2
I2-2 I2-2/	IGBT2 power part 2
I2-3 I2-3/	IGBT3 power part 2
I2-4 I2-4/	IGBT4 power part 2
PW ON NG	DC supply relay power on -
PW ON PO	DC supply relay pAower on +
RESET C/	system RESET command
SI PH ID/	single phase identifier
STOP X C/	stop X-ray command
TB 2/	tube 2
3/	" 3
TB 2 RT/	tube 2
TB 3 RT/	" 3
TH OL SW	tube housing overload switch
TH OL	tube housing overload
TP HT GND	temperature high tension tank ground
TP HT SG	temperature signal high tension tank
X ACT S/	X-ray active signal



Mnemonics

AC 0V XG	mains supply 0V X-ray generator
AC 230V L2	mains supply 230V AC phase 2
CAN H	generator CAN high
CAN L	generator CAN low
CAN IDF 0	
CAN IDF 1	
CTRL X C/	control X-ray command
EN X C/	enable X-ray command
FI TF1 1	filament transformer 1 line 1
FI TF1 2	" " 1 - 2
FI TF2 1	" " 2 - 1
FI TF2 1	" " 2 - 2
RESET C/	system RESET or switch on button RESET
STOP X C/	stop X-ray command
TB CU FR NG	tube current frequency negative
TB CU FR PO	tube current frequency positive
X ACT S/	X-ray active signal



A1/A3 94-10-07 Ost.
V00323

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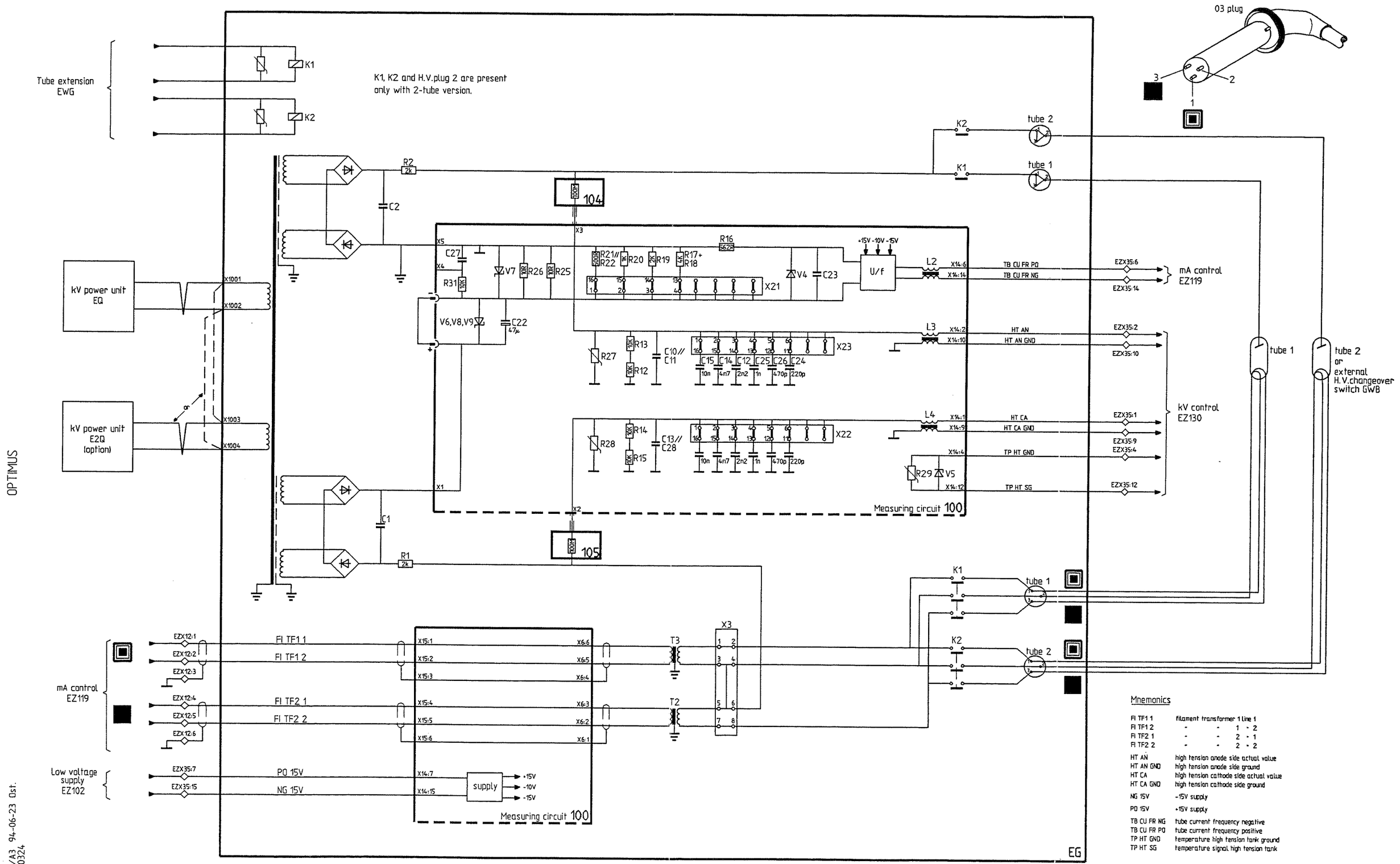
mA control

Z1-4.1



Mnemonics

FI TF1 1	filament transformer 1 Line 1
FI TF1 2	- - 1 - 2
FI TF2 1	- - 2 - 1
FI TF2 2	- - 2 - 2
HT AN	high tension anode side actual value
HT AN GND	high tension anode side ground
HT CA	high tension cathode side actual value
HT CA GND	high tension cathode side ground
NG 15V	-15V supply
PO 15V	+15V supply
TB CU FR NG	tube current frequency negative
TB CU FR PO	tube current frequency positive
TP HT GND	temperature high tension tank ground
TP HT SG	temperature signal high tension tank

Note:
In case errors were detected in the tank or on the measuring board, exchange the tank as a whole.

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H.V. generator

Z1-4.2

System control

External CAN/XS Bus

EZX45 Adapter 4 aux. units

EZX46 Operating panel

XRG Bus

EN X/
RQ PR X/
RQ SN X/
CTRL X/
X ACT/
V15 S
GNDS

CAN L
CAN H
RESET C/
PO 15V
MN ON
RQ MN ON
PO 12V
EZX47 Power supply (power ON)

EZX44 Function programming

GNDC
RX CAN 1
RX CAN 2
V15 C
V15 S
RESET SW/
GNDS

CAN L
CAN H
PO 15V

R1
R2

Programmed for: "Operating panel connected at EZX46"

Low voltage supply EZ 102
PO 5V
PO 15V
NG 15V
PO 26V

EZX23

Signal bus

X1:AC1 GNDS
X1:A2 RESET SW/
X1:C2 EN X/
X1:A3 RQ PR X/
X1:C3 RQ SN X/
X1:A4 CTRL X/
X1:A5 X ACT/
X1:AC6 V15 S

EZX42 EZX43

System CAN

RX CAN 2
X1:C15 RX CAN 1
X1:C16 CAN N
X1:A16 CAN P
X1:C17 GNDC
X1:A17 V15 C

galvanic decoupling

System interface

D38 Software key

D4 Flash ROM or EPROM

D5 Flash ROM or EPROM

Application ROM

W1
1 Flash ROM
2
3 EPROM

programmed according D4/D5

POWERFAIL/
S1
RESET KEY

W2
D13

G4 3V

CAN L X2:A3
CAN H X2:C3
RESET C/ X2:A6
CTRL X C/ X2:C6
STOP X C/ X2:A7
EN X C/ X2:C7
X ACT S/ X2:A8

EZX71
EZX72
EZX73
EZX74
EZX75
EZX76
EZX77

H1
Start
Selftest
CAN - announcement
Ready
Error

status X6

EZX52

CAN/XS bus for internal extensions

Interface control

Basic interface EZ 150 measuring chamber

X2:A16 DS MC SG
X2:C16 DS MC OV

DRC Interface
(MUX,ADC)

AT Bus

EZX61

DRC input

as pulsed frequency
LL
TV

X2:C17 DS BV OV
X2:A17 DS BV SG
X2:C18 DR BV OV
X2:A18 DR BV SG
X2:C19 DR TV NT
X2:A19 DR TV PT

X2:A20 DR FQ PQ
X2:C20 DR FQ NG

Main computer
(386 SX)

D3 EPROM Boot/ BIOS

Service PC

X5
DSR not used
RXD
TXD
DTR not used

X1:A10 POWERFAIL/

Low voltage power supply EZ 102

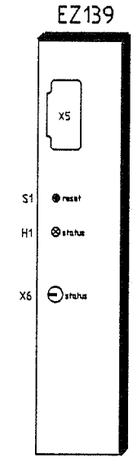
X2:AC1,2 +5V
X2:AC4,5
X2:AC11 +15V
X2:AC12 -15V

EZ139

Mnemonics

CAN H	generator CAN high active
CAN L	generator CAN low active
CAN N	system CAN negative data
CAN P	system CAN positive data
CTRL X/	signal bus X-ray request command
CTRL X C/	control X-ray command
DR BV OV	dose rate (signal) reference of image intensifier
DR BV SG	dose rate signal of image intensifier
DR FQ NG	dose rate signal (pulses) negative
DR FQ PQ	dose rate signal (pulses) positive
DR TV NT	dose rate of TV chain signal negative, fluora
DR TV PT	dose rate of TV chain signal positive, fluora
DS BV OV	dose (signal ramp) reference of image intensifier
DS BV SG	dose signal ramp of image intensifier signal
DS MC OV	dose (signal ramp) reference of selected measuring chamber
DS MC SG	dose signal ramp of selected measuring chamber
DSR	data set ready
DTR	data terminal ready
EN X/	signal bus enable X-ray
EN X C/	enable X-ray command
GNDC	CAN bus ground
GNDS	signal bus ground
MN ON	mains on
NG 15V	-15V supply
PQ 5V	+5V supply
PQ 12V	+12V supply
PQ 15V	+15V supply
PQ 26V	+26V supply
POWERFAIL/	power failure
RQ MN ON	ready mains power on
RQ PR X	ready preparing for X-ray
RESET C/	system RESET command
RESET KEY	CU reset
RESET SW/	signal bus reset, generator reset
RQ SN X/	request synchronization
RX CAN	system CAN optional
RX CAN 1	system CAN 1 optional
RX CAN 2	system CAN 2 optional
RXD	receive data
STOP X C/	stop X-ray command
TXD	transmit data
V15 C	system CAN +15V supply
V15 S	signal bus +15V supply
X ACT/	signal bus X-ray active
X ACT S/	X-ray active signal

EZ139



A1/A3 95-07-20 Schr./Ost.
u00634

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Central unit

Z1-5.1

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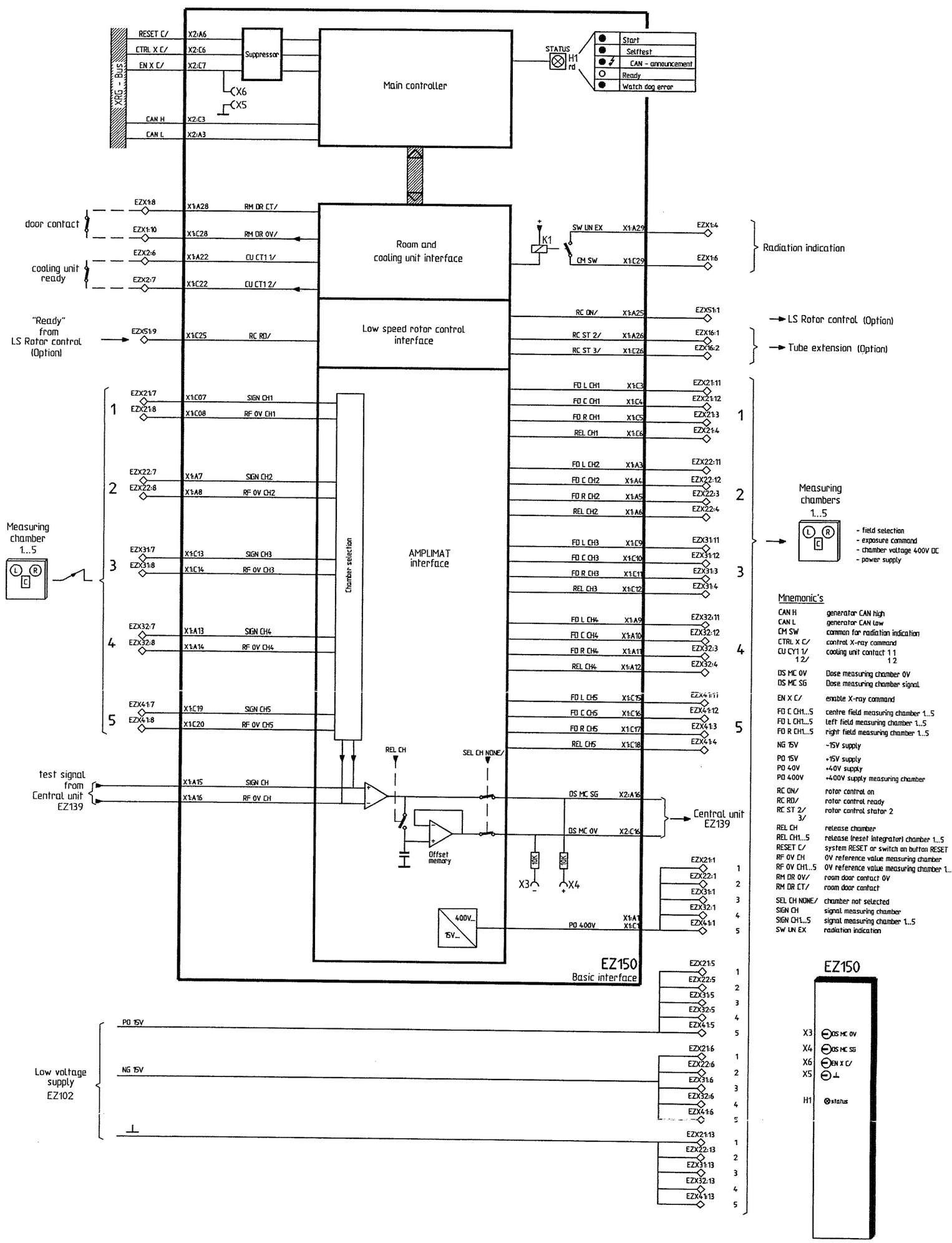
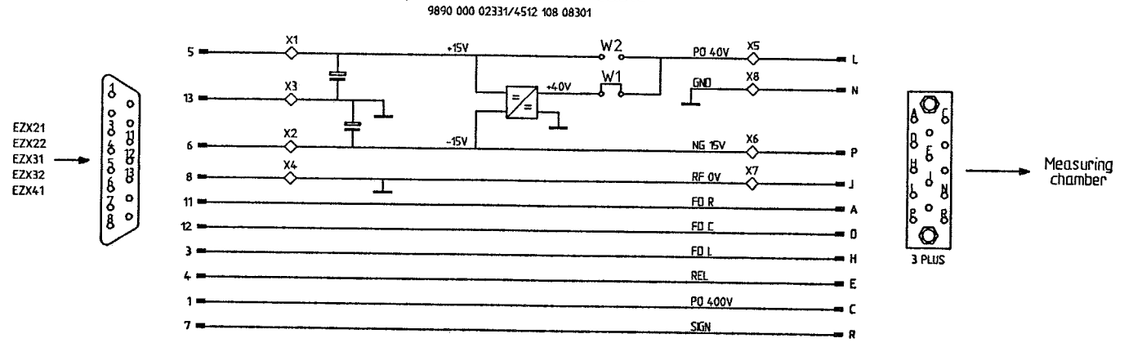
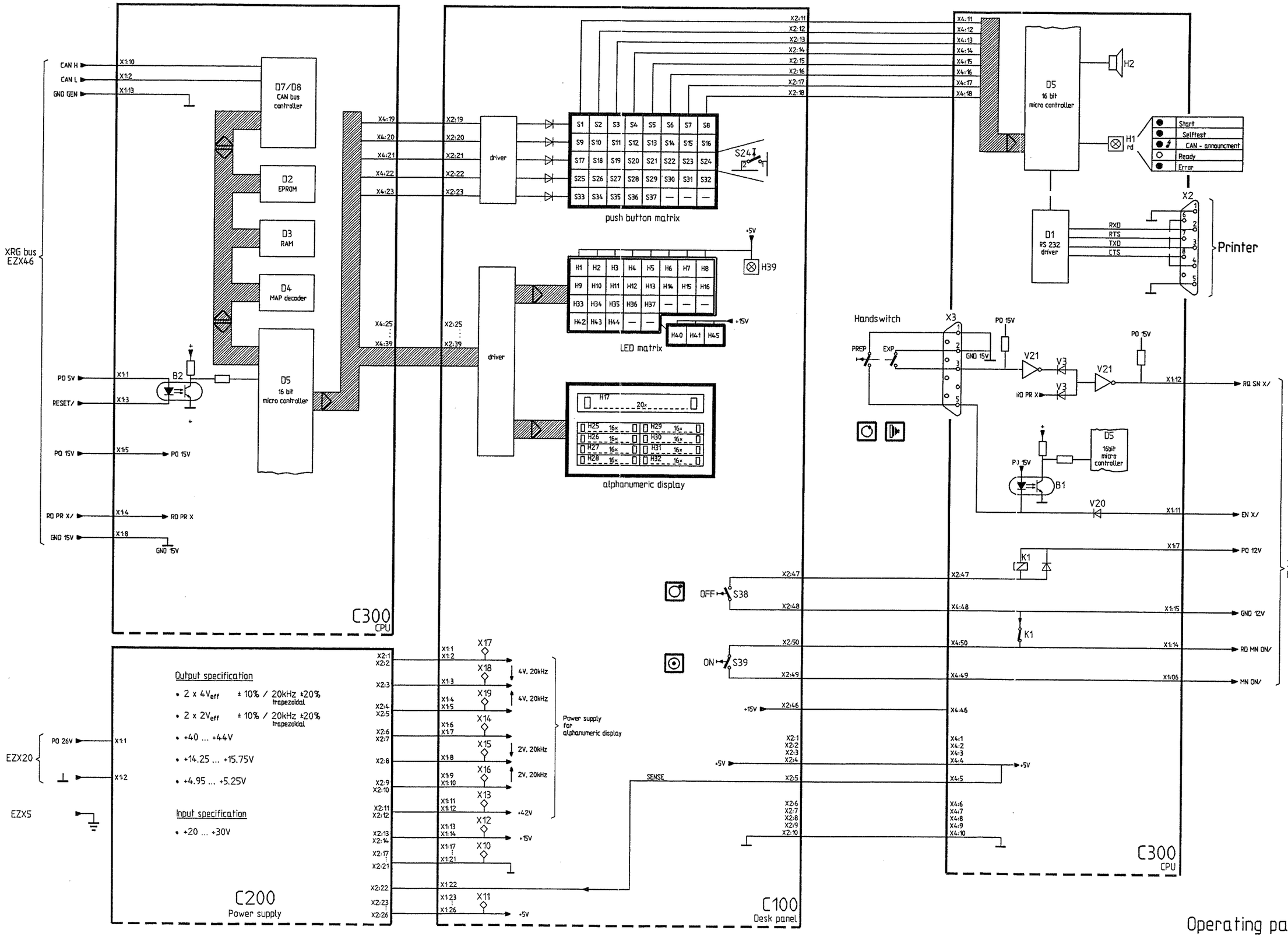


Adapter for AMPLIMAT cable

9890 000 02331/4512 108 08301





OPTIMUS

A1/A3 94-06-20 Ost.
V00275

Operating panel C

Z1-11.1

OPTIMUS (94.0)

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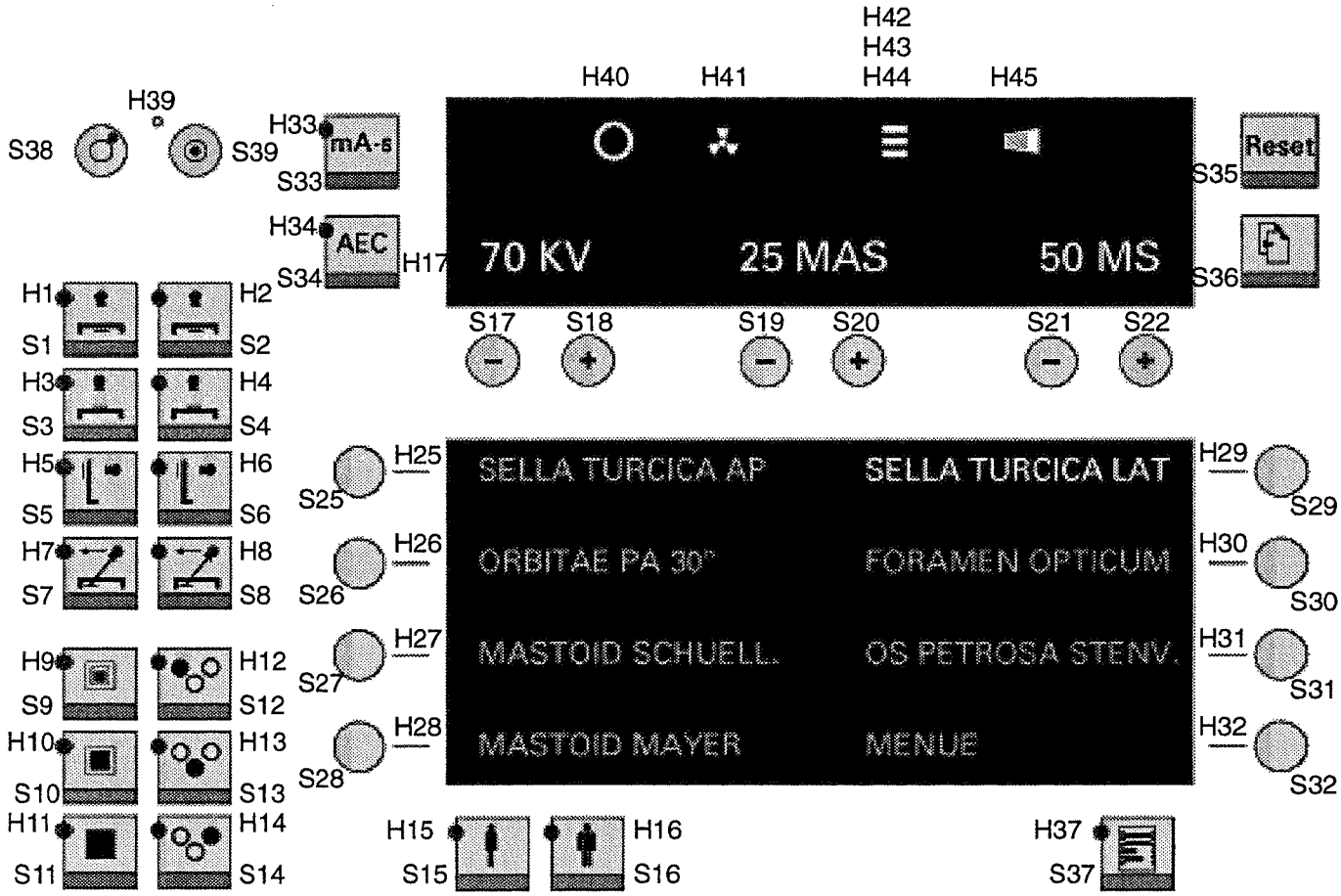

A4 94–06–17 Ost.
OPTIMUS_Z1–11_2

Button and display arrangement

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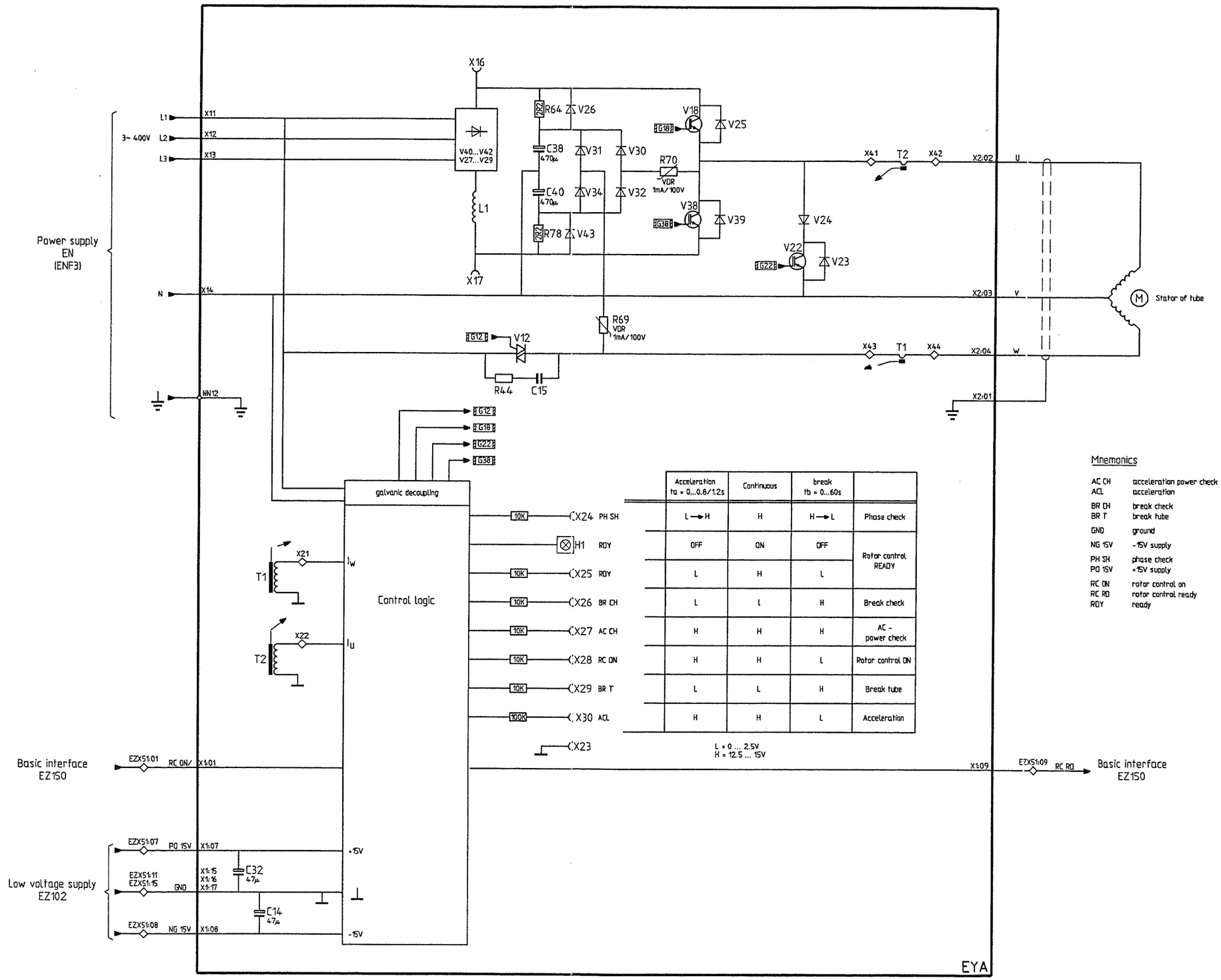

Mnemonics

AC CH	acceleration power check
ACL	acceleration
BR CH	break check
BR T	break tube
GND	ground
NG 15V	-15V supply
PH SH	phase check
PO 15V	+15V supply
RC ON	rotor control on
RC RD	rotor control ready
RDY	ready

A1/A3 94-06-16 Ost.
V00301

Low speed
Rotor control

Z1-12

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Power supply 3~ 400V from ENF3

L1 L2 L3 N — X1 X2 X3 X4

Filter and rectifier

L1 — X5 X6 — PO — 560V DC — X43

X7 X8 — NG — X44

NN1

EY200 Rectifier

R52 4.32K
R51 10K
R60 10K
R68 4.32K
R59 10K
R72 4.7K C65
C66
R79 4.7K C72

X56 P+ — X57 N-

IGBT - Modul

Filter

L3 L2 L1

X55 X54 X53

X6:2 U X6:3 V X6:4 W X6:5

RO/SRO tubes

NTC — X4 X5

STATUS — H1

- Start
- Selftest
- CAN-announcement
- Ready
- Watch dog error

at time not activated

RC ST 2/ X3:1
RC ST 3/ X3:2

Tube extension

R55 200
R54 200

X15 — 1V ≙ 5A

U I

Computer control

W1 1 2 3
W2 1 2 3

Driver with galvanic decoupling

X21 X22 X23 X24 X25 X26 X27 X28 X29 X30 X31 X32 — 1 2 3 4 5 6 7 8 9 10 11 12

IGBT-Modul

Mnemonics

CAN H	generator CAN high active
CAN L	generator CAN low active
NG	negative
PO	positive
RC ST 2/ 3/	rotor control stator 2 3
RESET C/	system RESET command

EZX51 — SYNC-BUS

X1:3 CAN H — X2:3
X1:2 CAN L — X2:2
X1:10 RESET C/ — X2:10

X11 — X1:7 — +15V
C2 C1 100µ
C6 C5 47µ
X14 — X1:8 — -15V
X1:4 X1:5 X1:6 — X12 — +5V
C3 C4 47µ
X1:11 X1:17 — X13 — GND

Coding	Rotor control 1st	2nd	3rd
W1	1 2 3		
W2	1 2 3		

+15V X2:7
-15V X2:8
+5V X2:6
X2:4 X2:5 X2:9 X2:11 X2:17

2nd/3rd rotor control

EY100 Rotor control HS

A1/A3 94-11-24 Dst./Schr.
V00302

High speed rotor control

Z1-13.2

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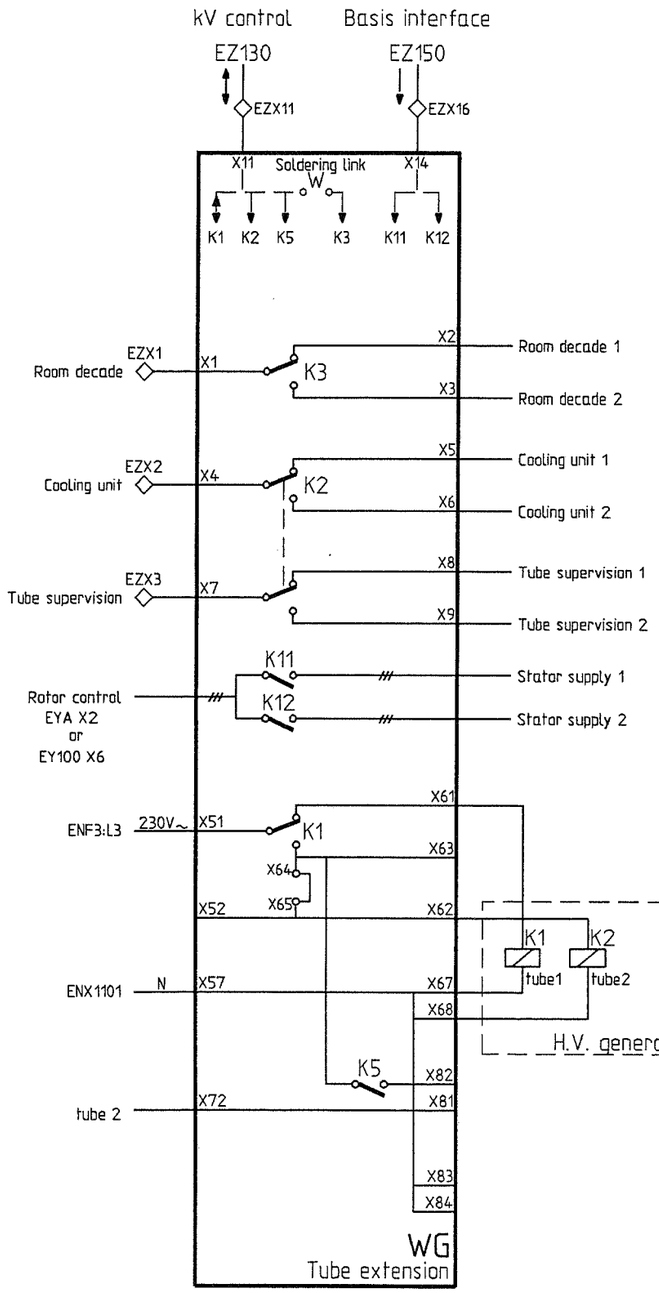
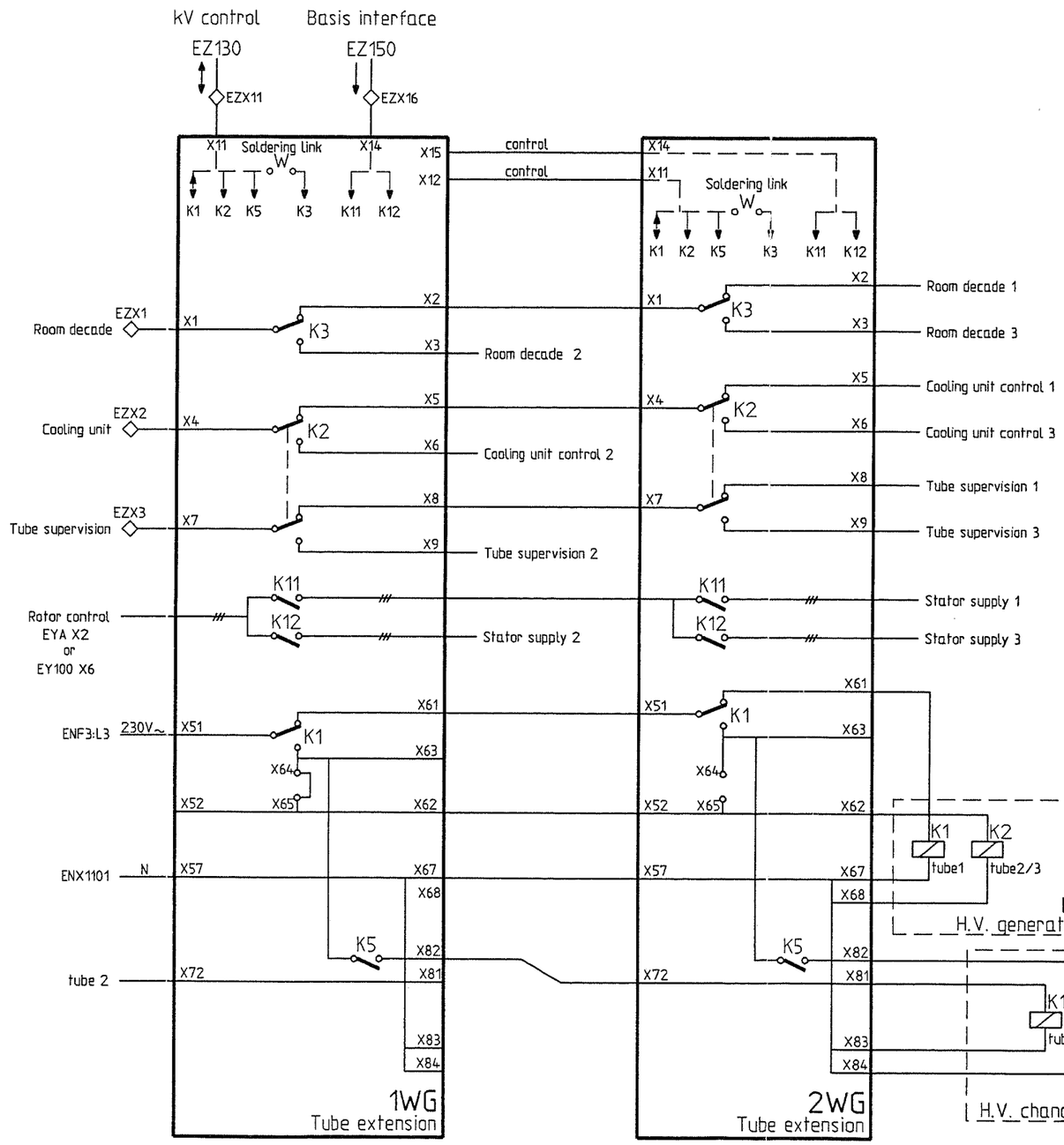
Tube extension for 2 tubes



Tube extensions for 3 tubes



Tube extension overview

Z1-14.1

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A2/A3 94-07-15 Ost.
v00292

OPTIMUS
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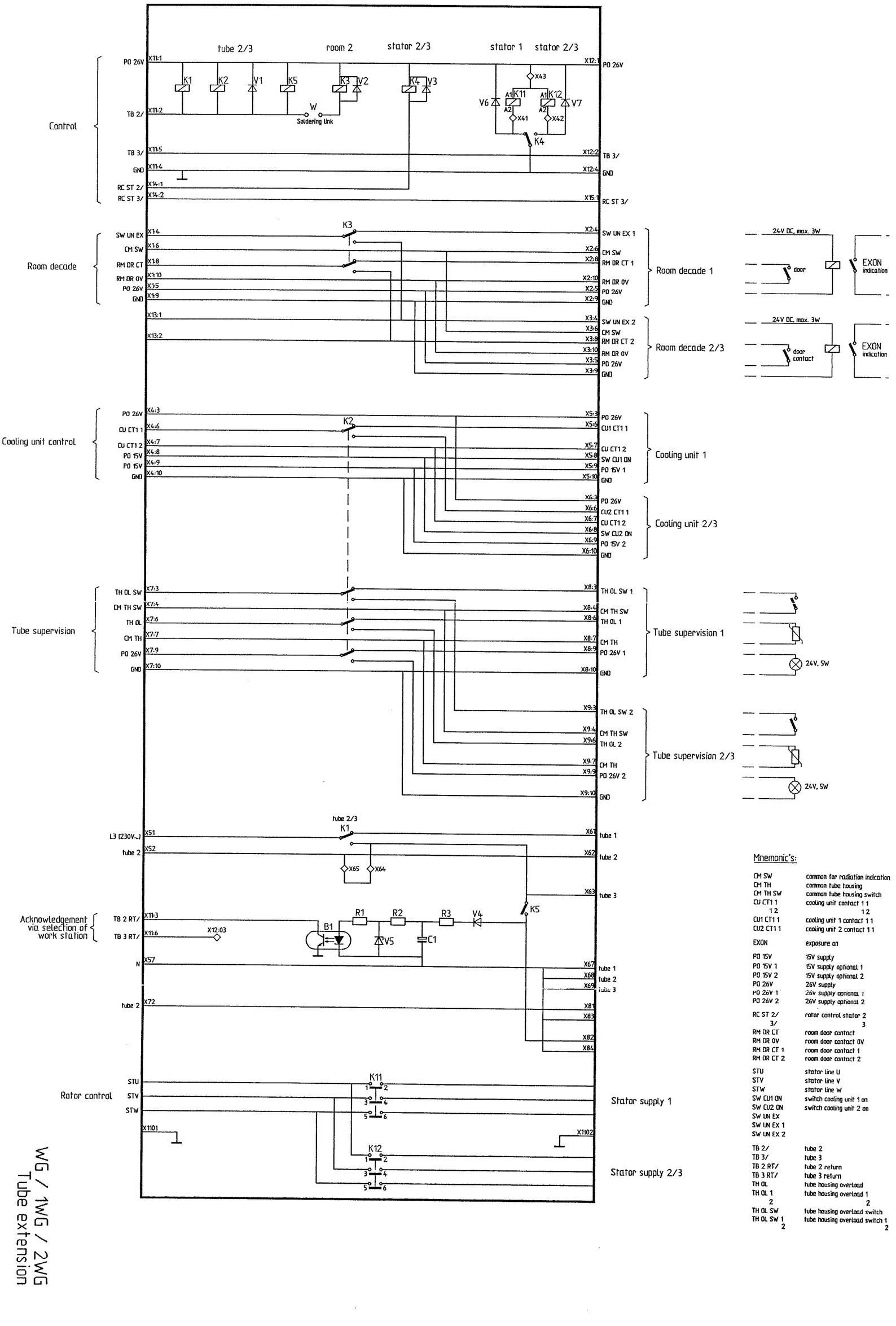
(94.1)



Mnemonic's:

CM SW	common for radiation indication
CM TH	common tube housing
CM TH SW	common tube housing switch
CU CT1 1 2	cooling unit contact 1 1 1 2
CU1 CT1 1	cooling unit 1 contact 1 1
CU2 CT1 1	cooling unit 2 contact 1 1
EXON	exposure on
PO 15V	15V supply
PO 15V 1	15V supply optional 1
PO 15V 2	15V supply optional 2
PO 26V	26V supply
PO 26V 1	26V supply optional 1
PO 26V 2	26V supply optional 2
RC ST 2/ 3/	rotor control stator 2 3
RM DR CT	room door contact
RM DR 0V	room door contact 0V
RM DR CT 1	room door contact 1
RM DR CT 2	room door contact 2
STU	stator line U
STV	stator line V
STW	stator line W
SW CU1 ON	switch cooling unit 1 on
SW CU2 ON	switch cooling unit 2 on
SW UN EX	
SW UN EX 1	
SW UN EX 2	
TB 2/	tube 2
TB 3/	tube 3
TB 2 RT/	tube 2 return
TB 3 RT/	tube 3 return
TH OL	tube housing overload
TH OL 1 2	tube housing overload 1 2
TH OL SW	tube housing overload switch
TH OL SW 1 2	tube housing overload switch 1 2

OPTIMUS
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(94.1)

EZX19 / EZX45 for WA
or
WNX21 / EZX45 for 1WA
or
TWAX42 / TWAX52 for 2WA

X41:1 X41:2 X51
PO 26V

Release 1(5) Release 2(6) Release 3(7) Release 4(8)
X1 X2 X3 X4

RQ XG EX — X1:A3
XG RQ EX 1 — X1:C3
XG RQ EX 2 — X1:A6
XG RQ EX 3 — X1:A8
XG RQ EX 4 — X1:A10
RQ XG PR 1 — X1:A4
RQ XG PR 2 — X1:C6
RQ XG PR 3 — X1:C8
RQ XG PR 4 — X1:C10
PO 26V RE — X1:AC1
RG OV 1 — X1:C4
RG OV 2 — X1:A7
RG OV 3 — X1:A9
RG OV 4 — X1:A11
RQ XG FL — X1:A5
GND 2 — X1:AC2
CM EX SW 1 — X1:C5
CM EX SW 2 — X1:C7
CM EX SW 3 — X1:C9
CM EX SW 4 — X1:C11

K14 K15 K16 K17

Tomo

Test PREP S2
RQ PR/
Test FLUORO S1

Release control
(galvanic decoupled)

X2:C25 CTRL X/
X2:A25 RQ SN X/
X2:C26 EN X/

+26V +5V DC/DC X2:AC14 PO 26V
X2:AC15

+15V X2:AC27 V15 S
C75
X2:AC28 GND S

K14...K17 Release 1...4
+26V
K4...K11 TO PG 1...8
K12 TO PG SL

I/O brain

X2:C3 CAN H
X2:A3 CAN L
X2:A6 RESET C/
X2:A21 COD 1
X2:C21 COD 2
X2:A22 COD 3
W1 W2 W3

Function unit	W1	W2	W3
WA ≙ ADAP_a	–	–	–
1WA ≙ ADAP_a	–	–	–
2WA ≙ ADAP_b	×	–	–

Bucky 1(3) Bucky 2(4) closed: opened:
X11 X12

Format contact — SW SF CF 1 — X1:A18
SW SF CF 2 — X1:A20
Tomo mode — SL XG TO — X1:C18
Tomo ready — SW TO 1 — X1:A19
SW TO 2 — X1:C20
Bucky ready — SW BU 1 — X1:C19
SW BU 2 — X1:A21

Bidirectional I/O interface

status H1
Start
Selftest
CAN - announcement
Ready
Error

CAN/XS bus

X13 X14
EXON
EX ON — X2:A9
IT 0V — X2:C9

EXON Interface Logic
X ACT/
RQ PR
EX ON
10R
RQ PR/
X2:C24 X ACT/

Tomo times
X21
SL TO TM 1 — X1:A24
SL TO TM 2 — X1:C24
SL TO TM 3 — X1:A25
SL TO TM 4 — X1:C25
SL TO TM 5 — X1:A26
SL TO TM 6 — X1:C26
SL TO TM 7 — X1:A27
SL TO TM 8 — X1:C27

PO 26V
W11 W12 W13
PO 26V RE GND 2
X42:1 X42:2 X52
Expansions

Tomo trajectories
X22
TO PG 1 — X1:A13 — K5
TO PG 2 — X1:C13 — K4
TO PG 3 — X1:A14 — K7
TO PG 4 — X1:C14 — K6
TO PG 5 — X1:A15 — K9
TO PG 6 — X1:C15 — K8
TO PG 7 — X1:A16 — K11
TO PG 8 — X1:C16 — K10
TOMO PG — X1:A17
TO PG SL — X1:C17 — K12

External APRT
X23
SL PG 1 — X1:A28
SL PG 2 — X1:C28
SL PG 3 — X1:A29
SL PG 4 — X1:C29
SL PG 5 — X1:A30
SL PG 6 — X1:C30
SL PG 7 — X1:A31
SL PG 8 — X1:C31
PO 26V

PTC
X24
PO 26V
SL CO 1 — X1:A32
SL CO 2 — X1:C32

Universal I/O interface
102

Mnemonics

CAN H	generator CAN high active
CAN L	generator CAN low active
CM EX SW 1...4	common for exposure switch of registration device
COD1...3	coding
CTRL X/	signal bus X-ray request command
EN X/	signal bus enable X-ray
EX ON	exposure on
GND 2	ground
GND S	signal bus ground
IT 0V	emitter 0V exposure on signal
PO 26V	+26V supply
PO 26V RE	+26V supply reverse
RESET C/	system RESET command
RG OV 1...4	registration device
RQ PR/	request preparation
RQ SN X/	request synchronization
RQ XG EX	request X-ray generator for exposure
RQ XG FL	request X-ray generator for fluoroscopy
RQ XG PR1...4	request X-ray generator for preparation
SL CO 1	select correction 1 (thickness)
SL CO 2	select correction 2 (thickness)
SL PG 1...8	select ext APRT program
SL TO TM 1...8	select tomo time
SL XG TO	select X-ray generator for tomography
SW BU 1	switch bucky 1
SW BU 2	switch bucky 2
SW SF CF 1	switch side field to central field bucky measuring chamber 1
SW SF CF 2	switch side field to central field bucky measuring chamber 2
SW TO 1	switch tomography 1
SW TO 2	switch tomography 2
TOMO PG	tomo mode programmed
TO PG 1...8	tomo program
TO PG SL	tomo program selected
V15 S	signal bus +15V supply
X ACT/	signal bus X-ray active
XG RD EX 1...4	X-ray generator ready for exposure request

WA / 1WA / 2WA
Adaptor 4 auxil. units

Z1-15.1

Wirings

File: OPTIMUS.Z0-94.1

Cabinet E	Z2- 1.0
Cabinet wiring E, 50 kW	Z2- 1.1
Cabinet wiring E, 65/80/100 kW	Z2- 1.2
Power supply N, 50 kW	Z2- 2.1
Power supply N, 65/80/100 kW	Z2- 2.2
Mains transformer	Z2- 2.3
kV power unit Q/2Q	Z2- 3
Back panel basis rack Z	Z2- 5.1/2
Low speed rotor control YA	Z2-12
High speed rotor control Y	Z2-13
Tube extension WG	Z2-14.1
Tube extension WG	Z2-14.2
Tube extension 1WG/2WG	Z2-14.3
Adapter 4 auxil.units WA	Z2-15.1

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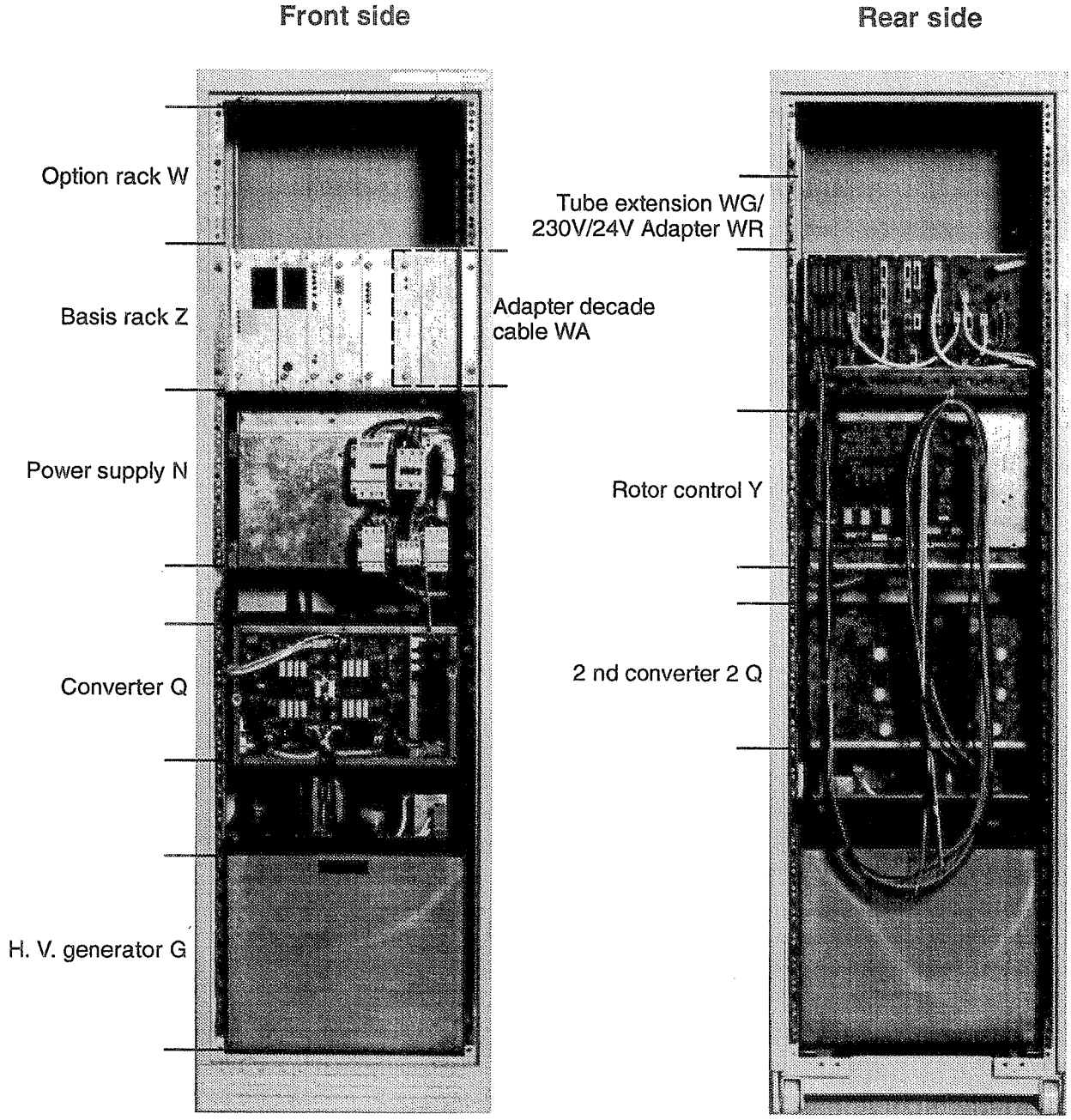

Cabinet E

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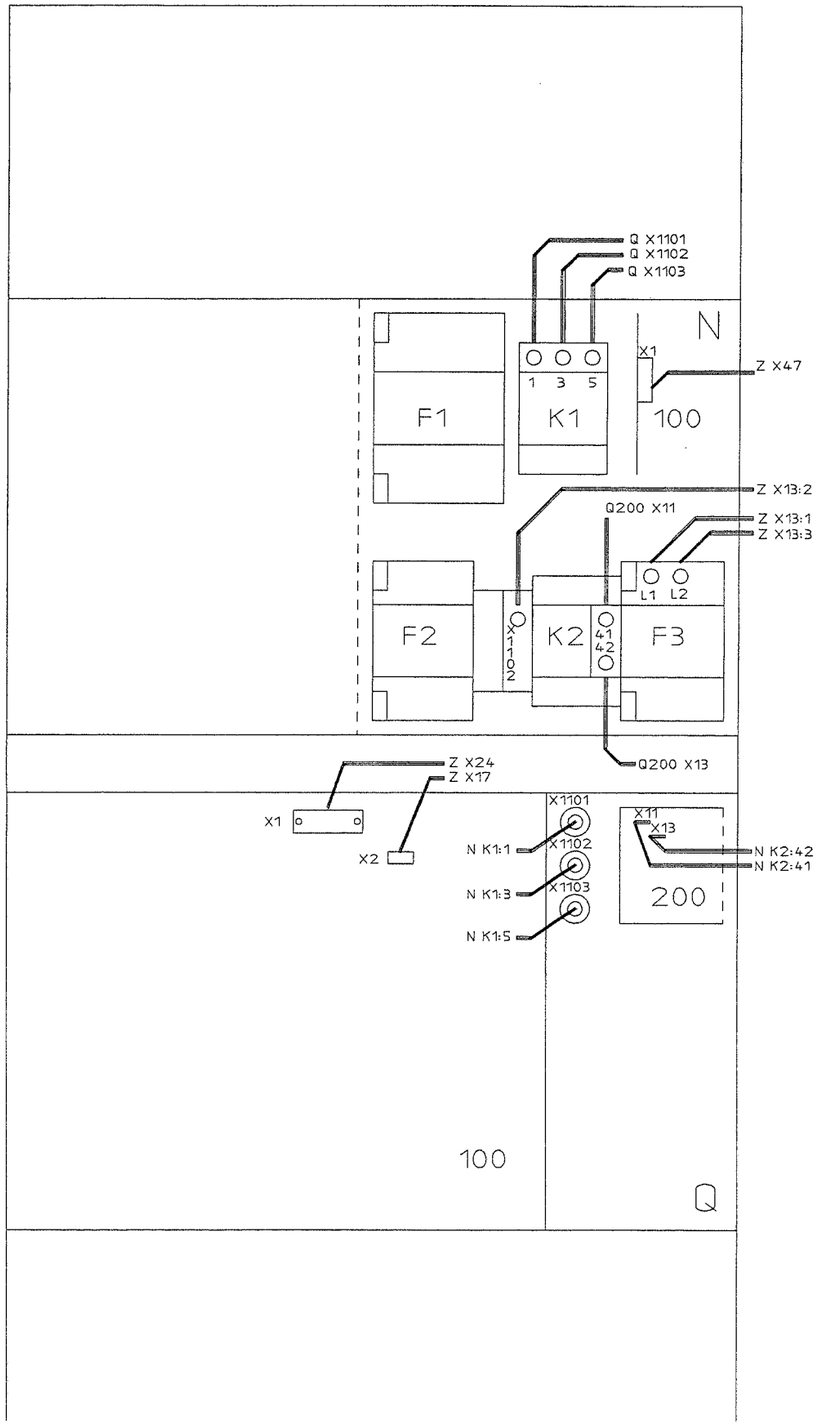
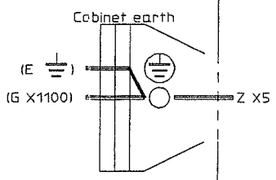
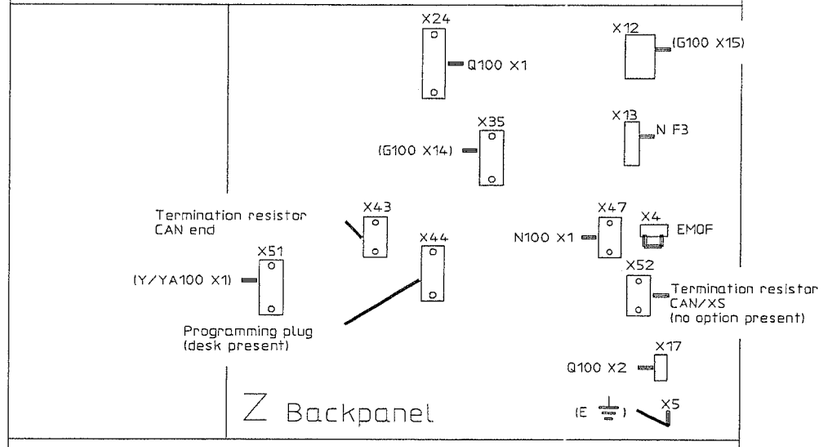
front

rear







A3/A3 94-10-07 Ost.
v00337

E
Cabinet wiring
50kW

Z2-1.1

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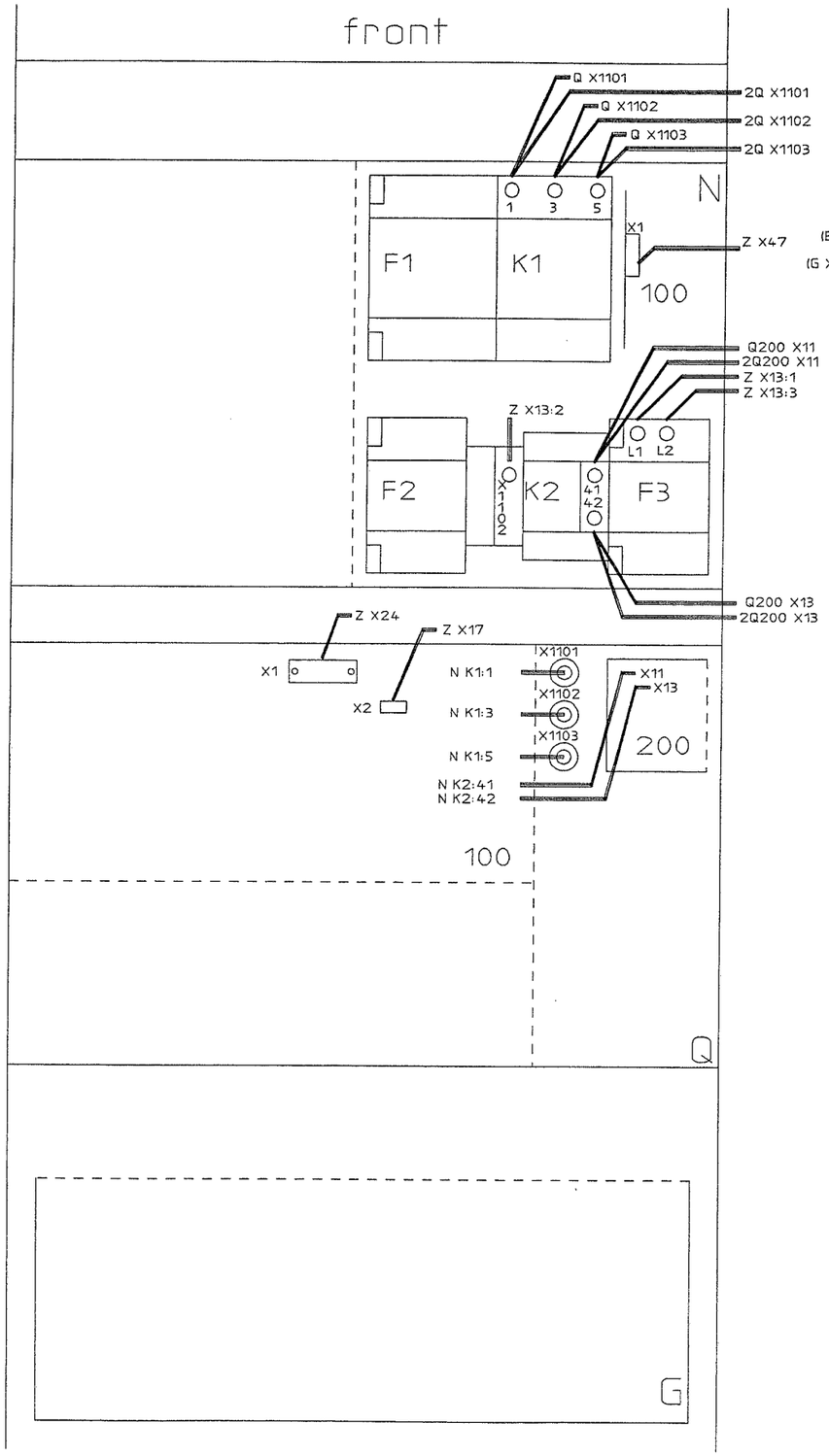

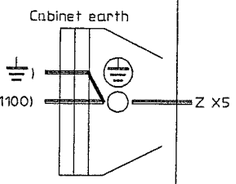

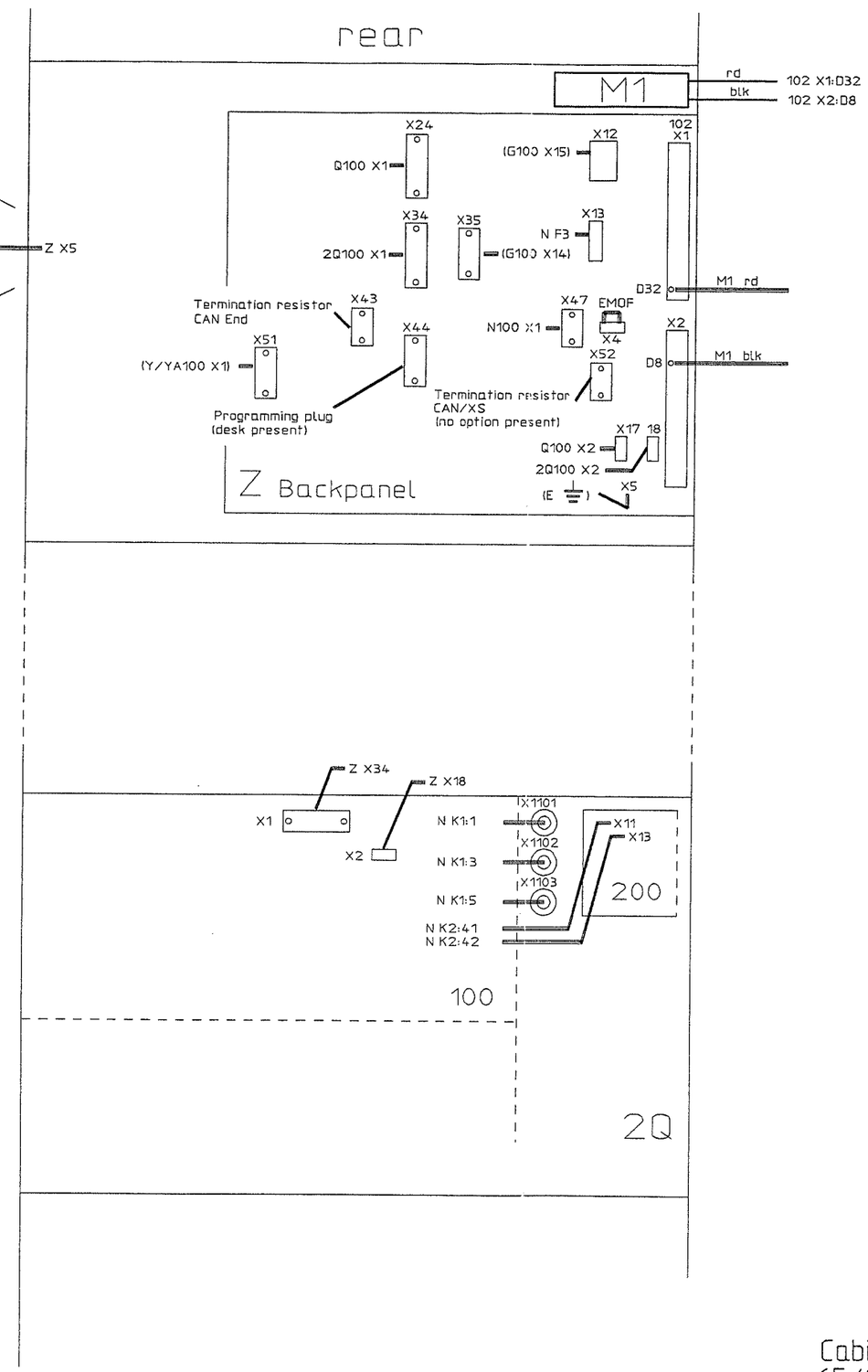

A3/A3 94-12-14 Schr.
u00694

E
Cabinet wiring
65/80/100kW

Z2-1.2

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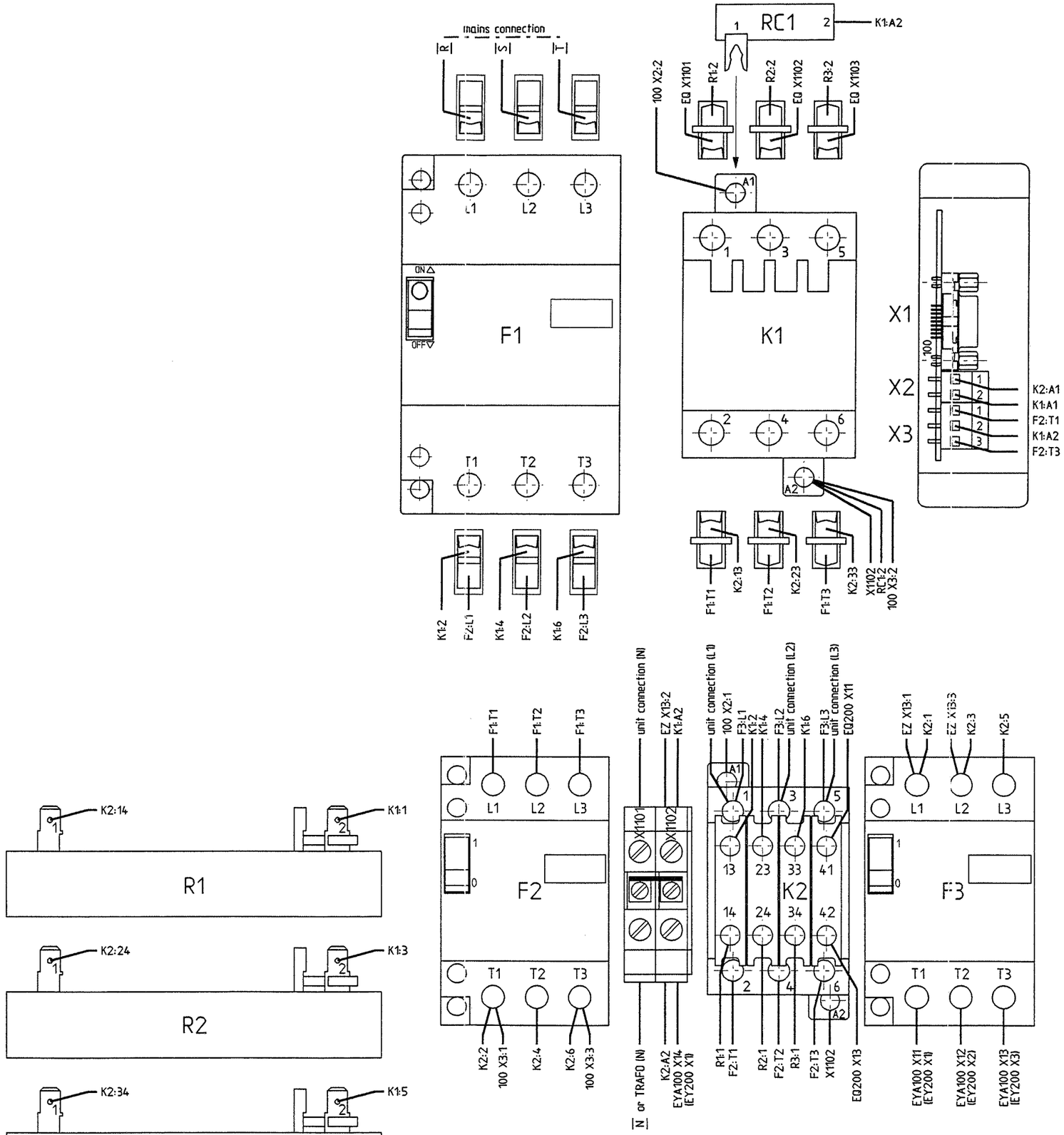

A2/A3 94-10-06 Ost.
v00326

OPTIMUS (94.0)
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N
Power supply
50kw

Z2-2.1

OPTIMUS
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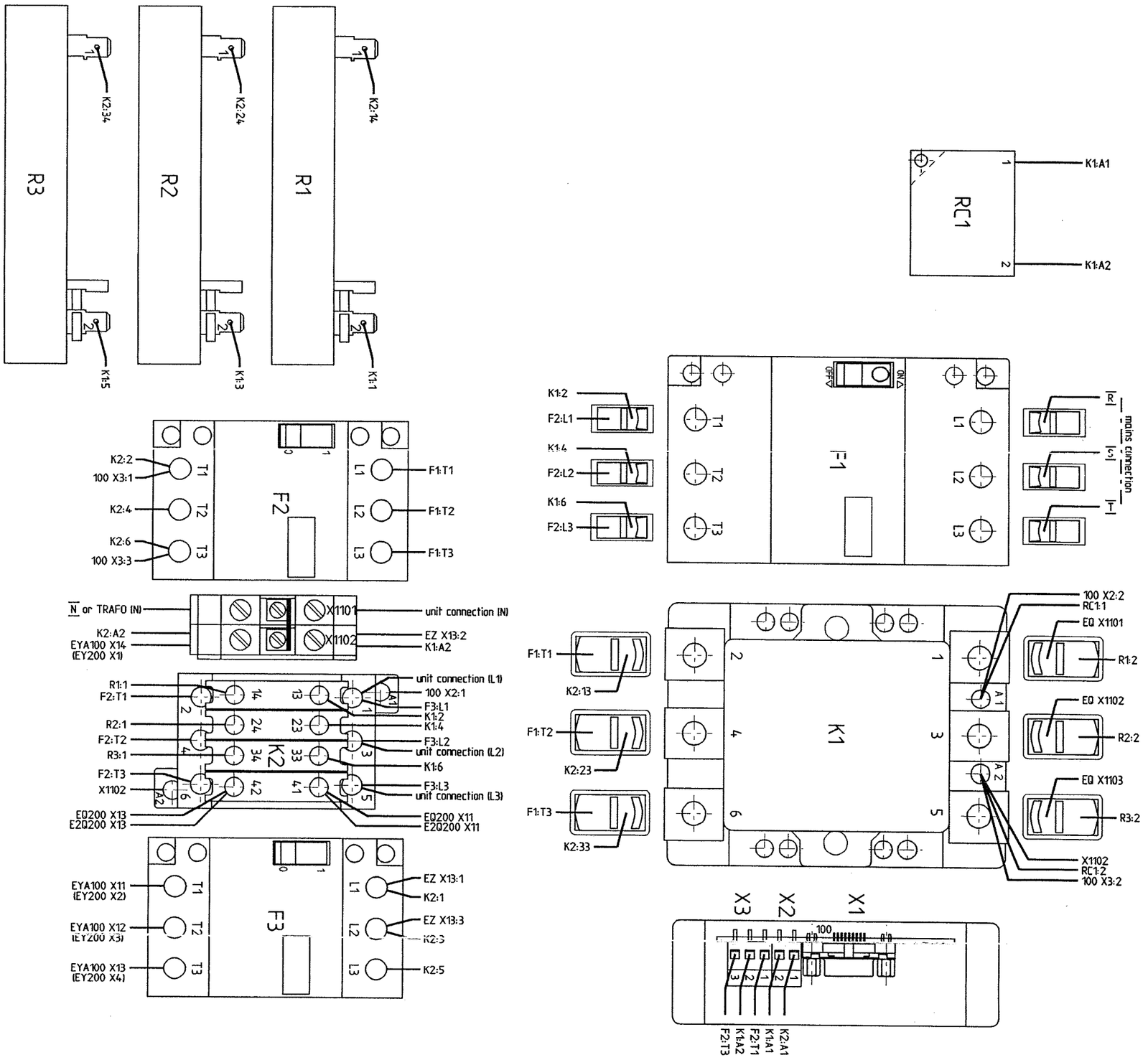
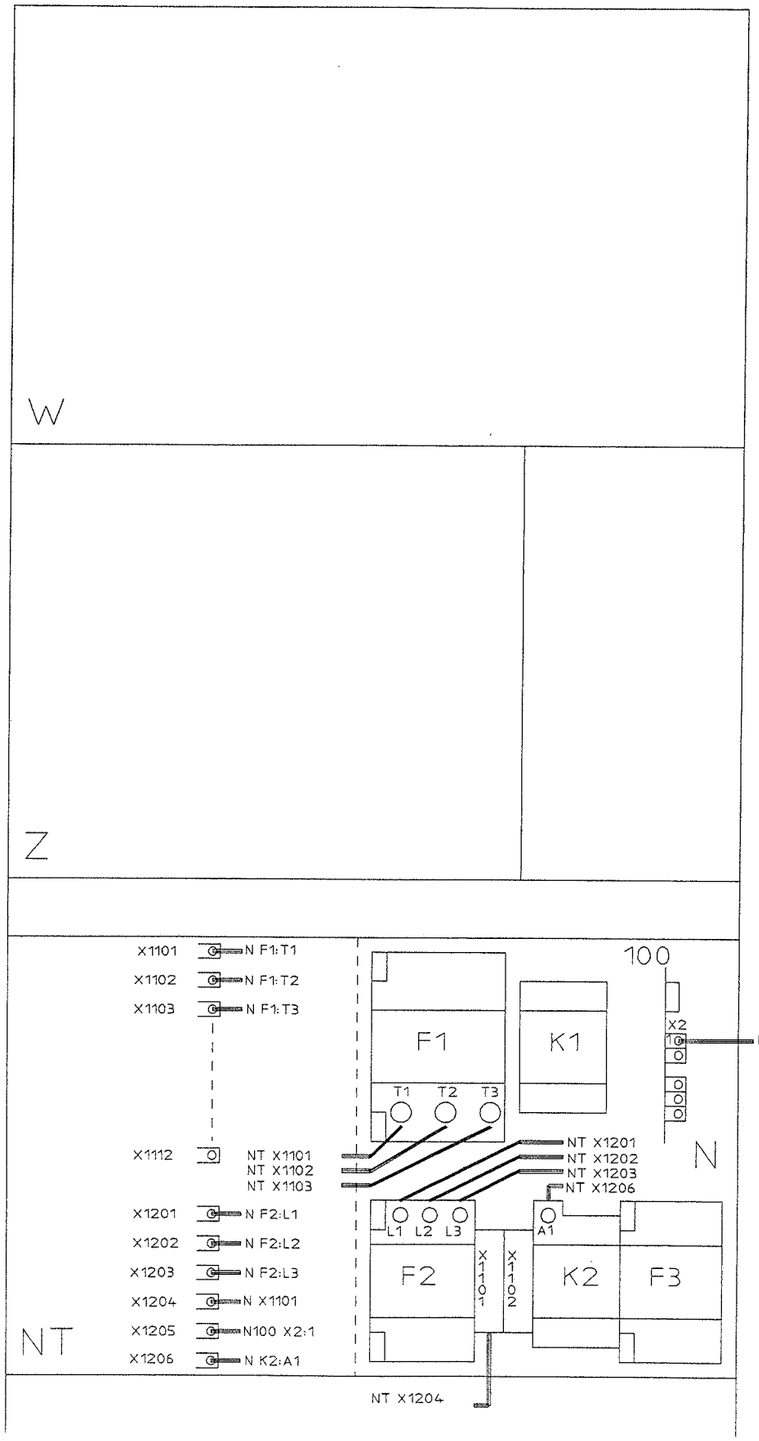


N
Power supply
65/80/100kW
Z2-2.2

front



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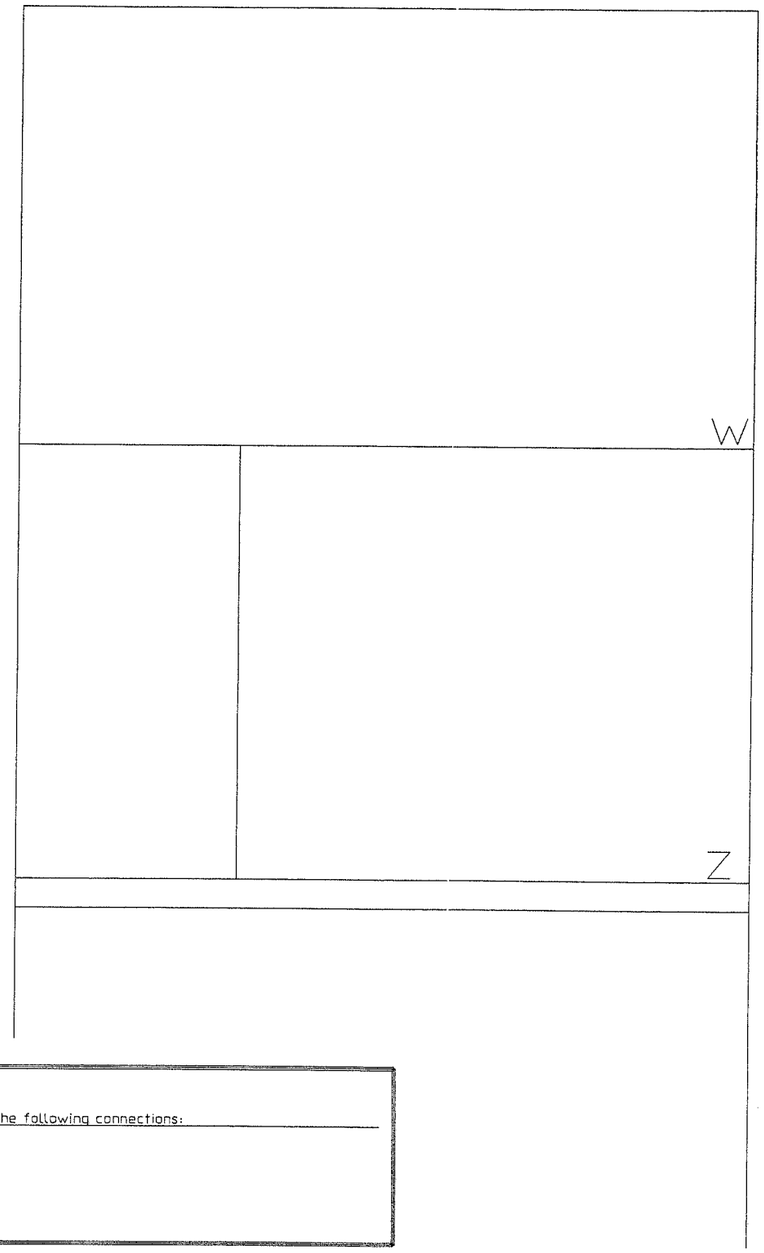

Caution

Befor installing NT cancel the following connections:

N F1:T1 - N F2:L1
N F1:T2 - N F2:L2
N F1:T3 - N F2:L3
N K2:A1 - N100 X2:1

N X1101 - N

A3/A3 94-10-07 Ost.
v00339

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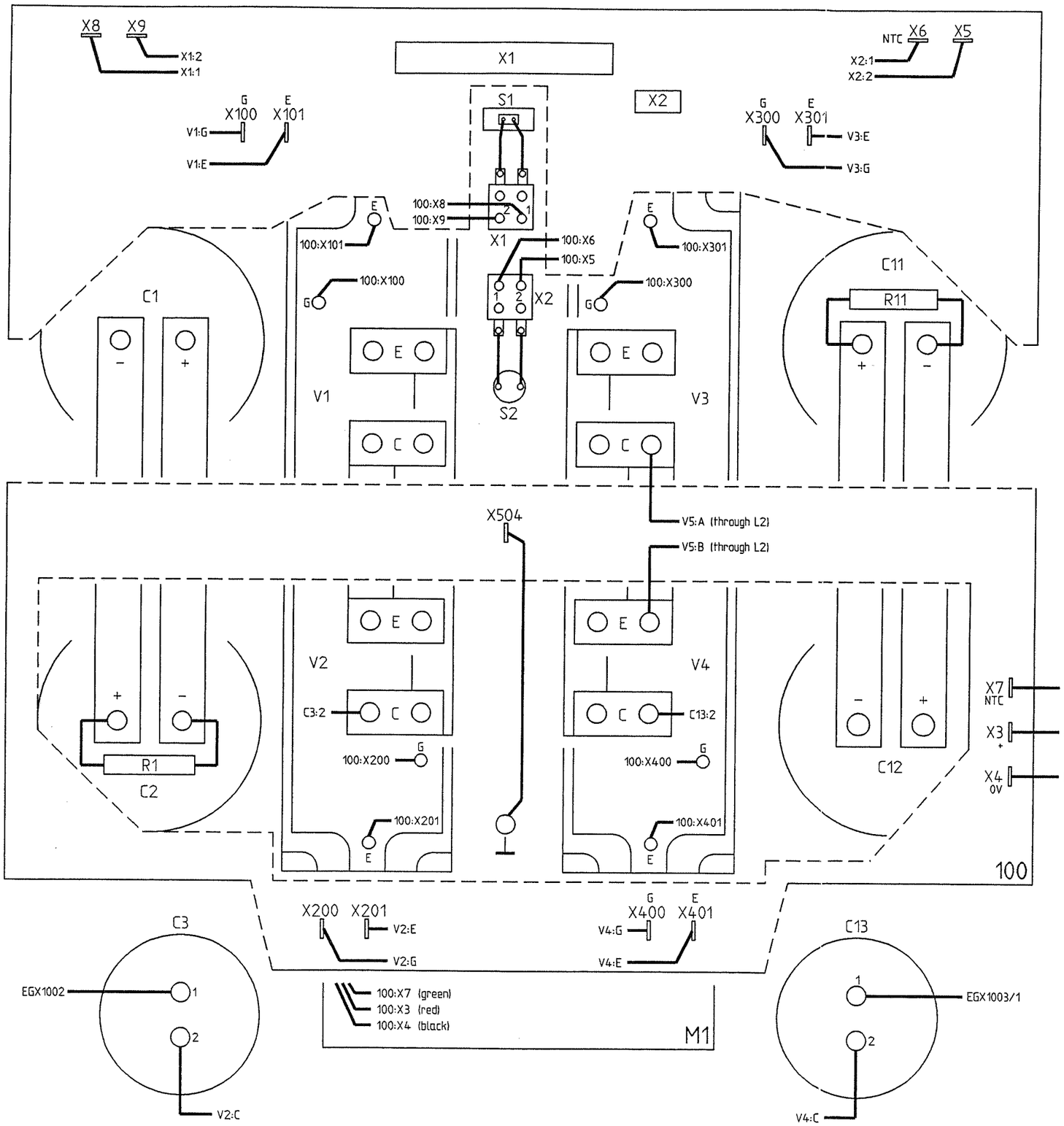
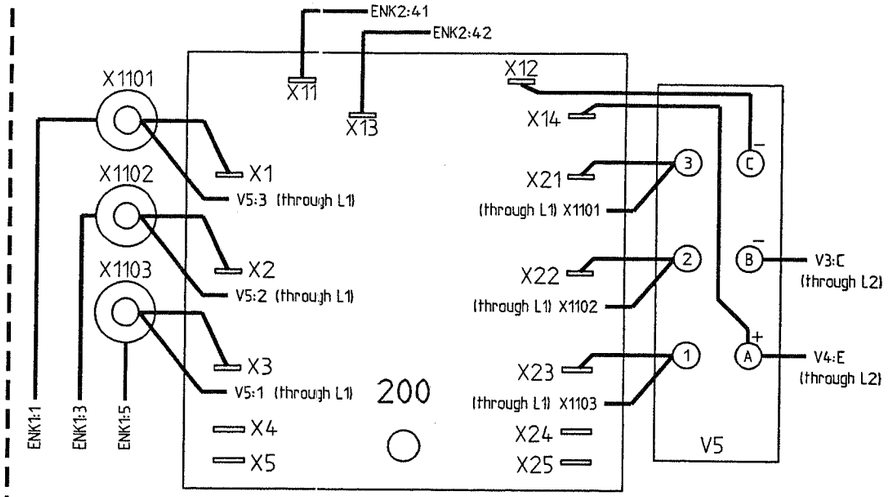
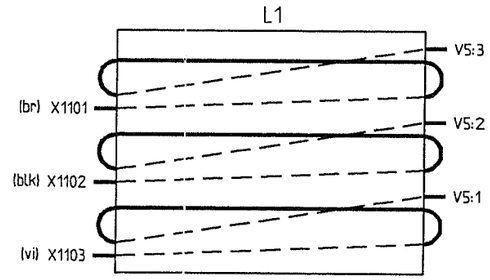
Mains transformer

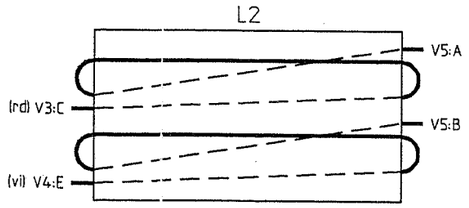
Z2-2.3





Note: X1, X2, and X3 not connected if P≥65kW





A2/A3 94-12-14 Ost.
v00309

Q/2Q
kV power unit

Z2-3

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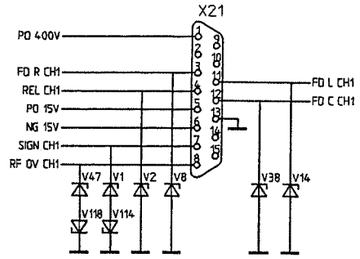
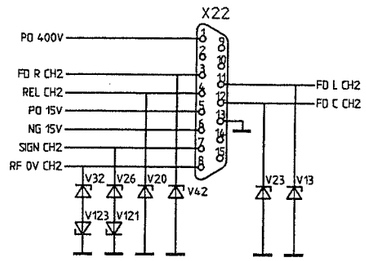
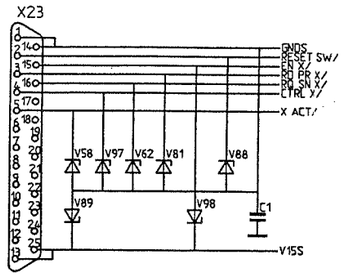
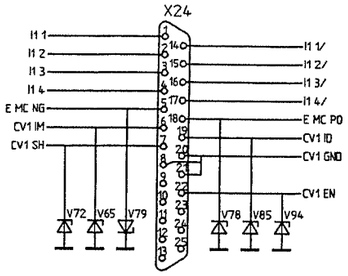
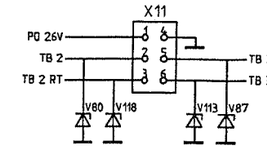
OPTIMUS

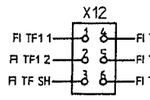


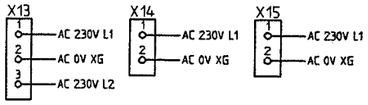


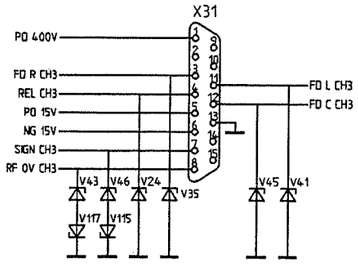


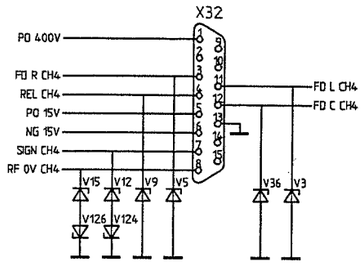


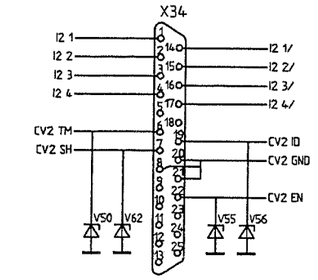


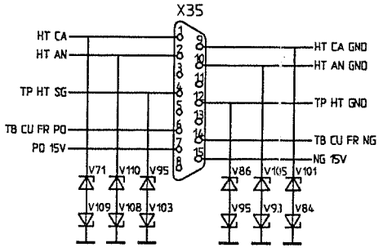


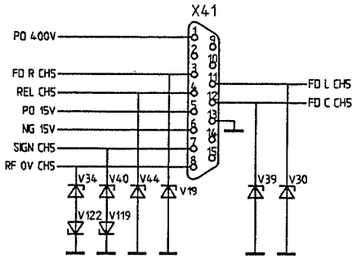


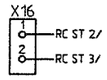


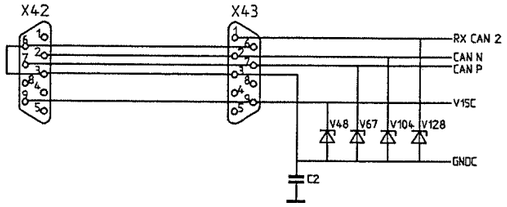


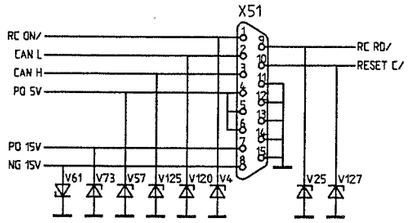




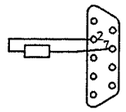


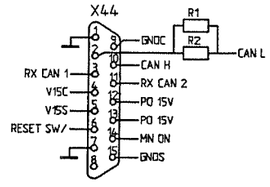






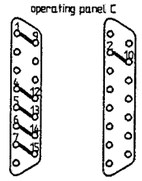
Termination resistor for X43

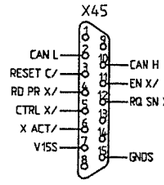


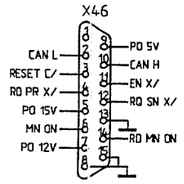


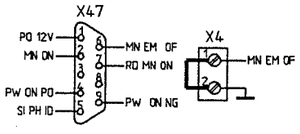
Function programming plug for X44

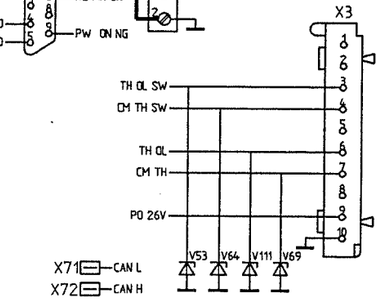
with / without operating panel C

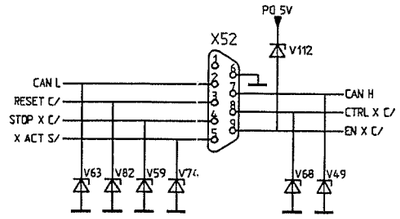




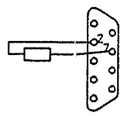


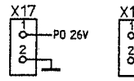


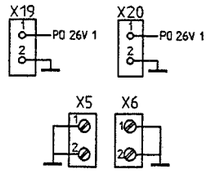


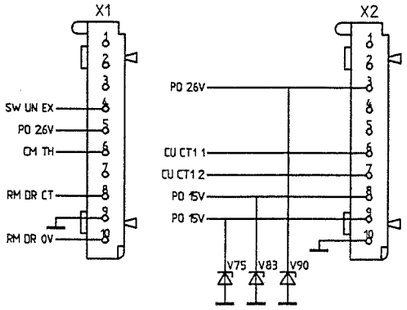


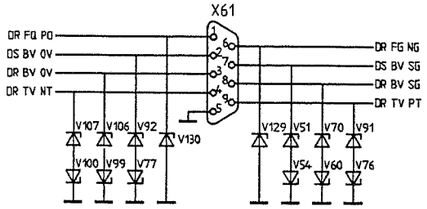
Termination resistor for X52



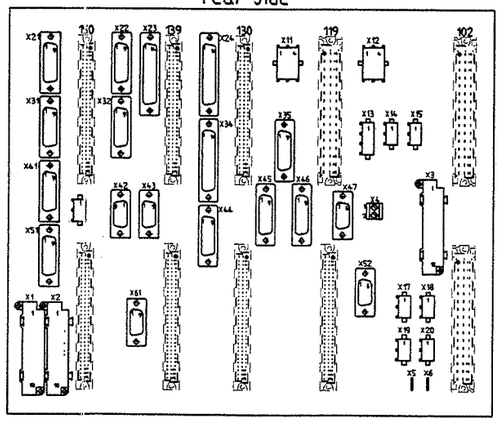








rear side



A1/A3 94-06-17 Ost.
v00314

OPTIMUS (94.0)

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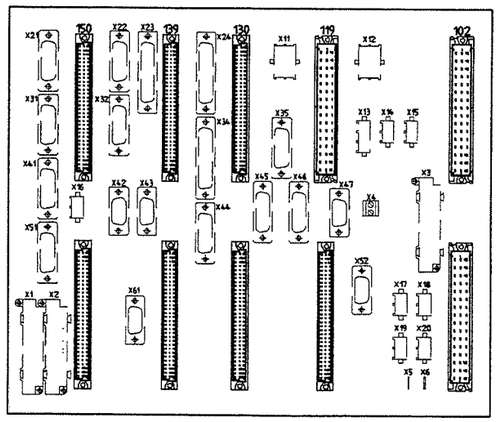
Back panel
Basis rack Z

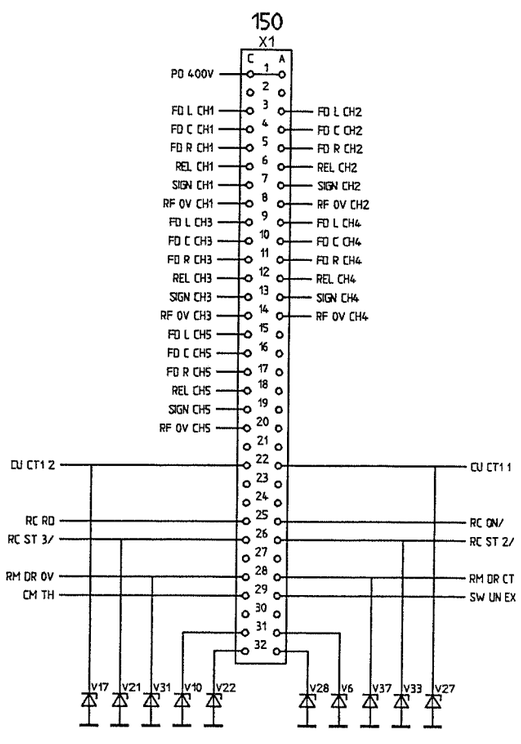
Z2-5.1

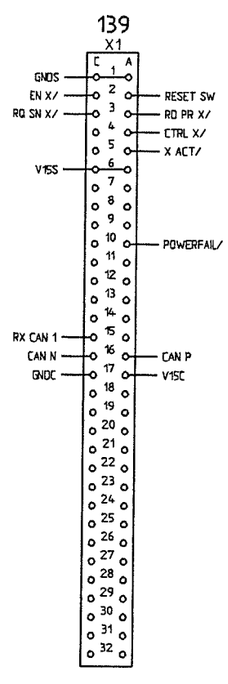
OPTIMUS

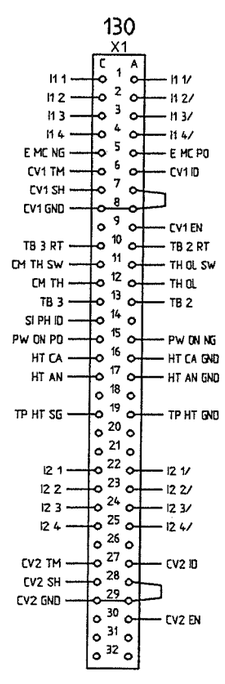
A1/A3 94-06-20 Ost.
v00315

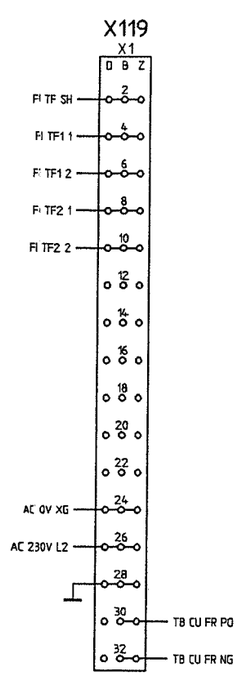
rear side

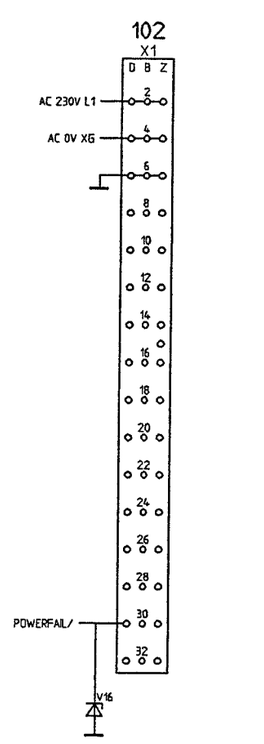


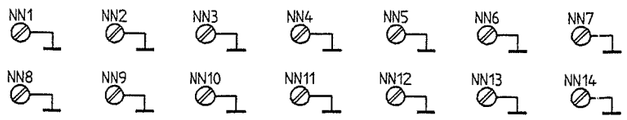












Back panel
Basis rack Z

Z2-5.2

OPTIMUS (94.0)

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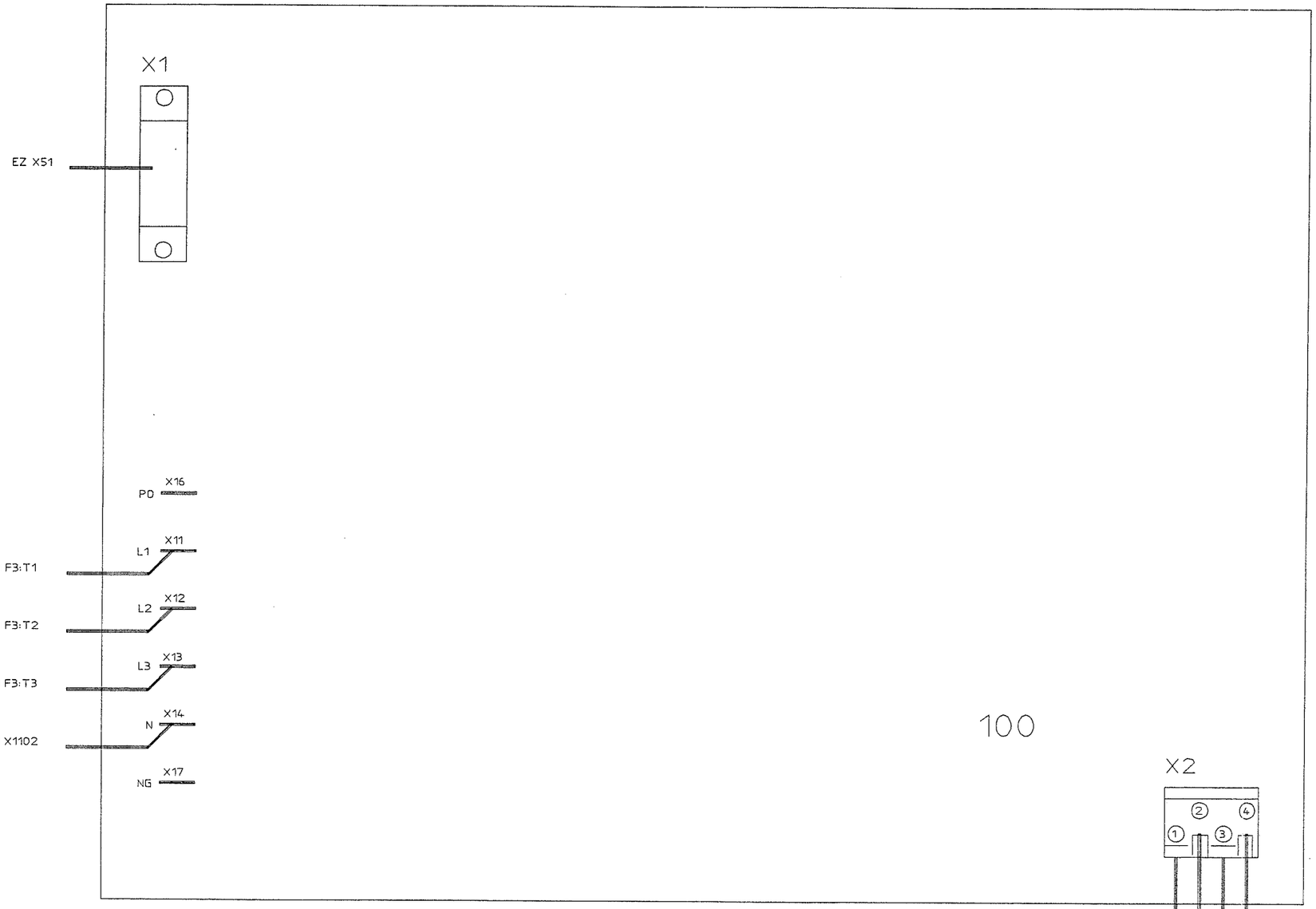

A3/A3 94-10-07 Ost.
v00342

YA
Low speed rotor control

Z2-12

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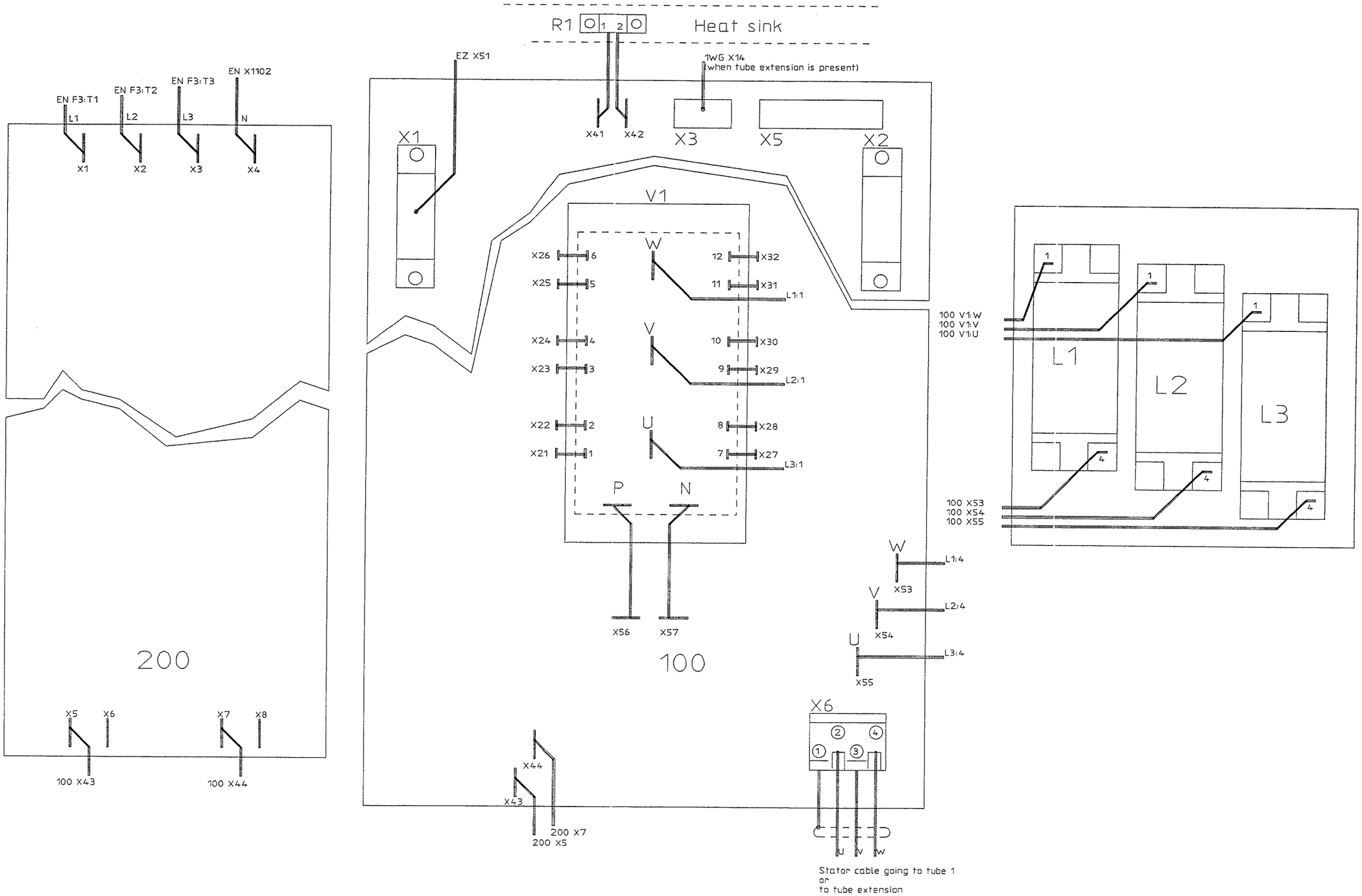

A3/A3 94-10-07 Ost.
v00343

OPTIMUS (94.0)
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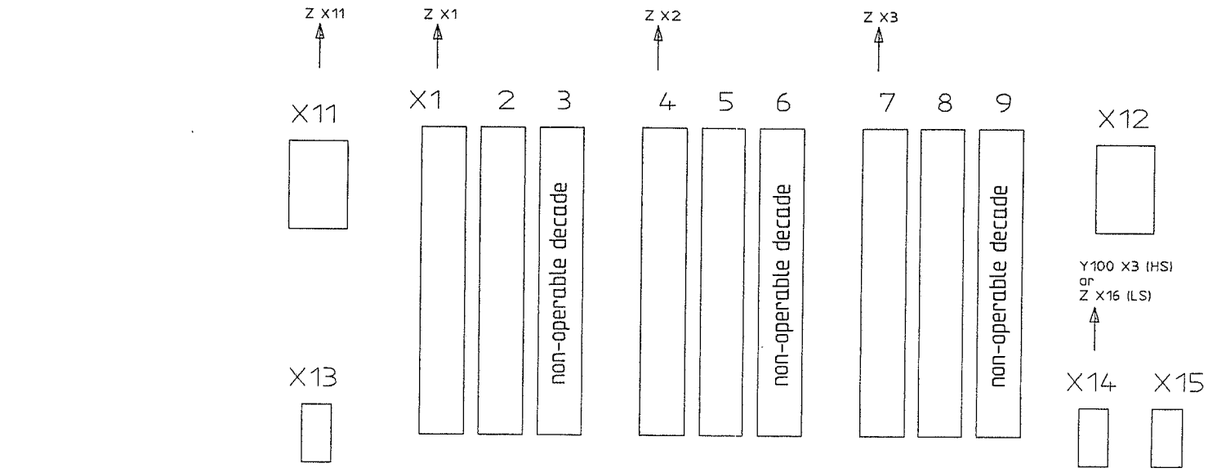
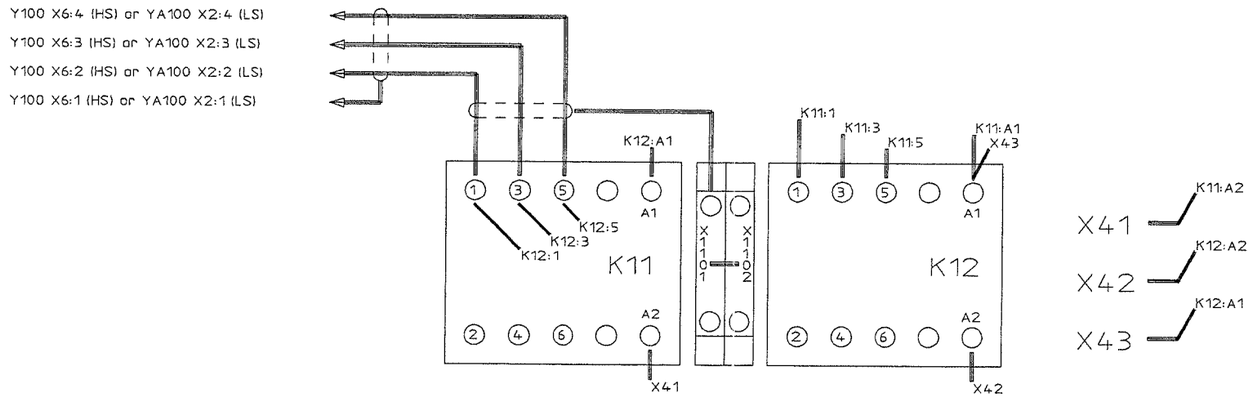
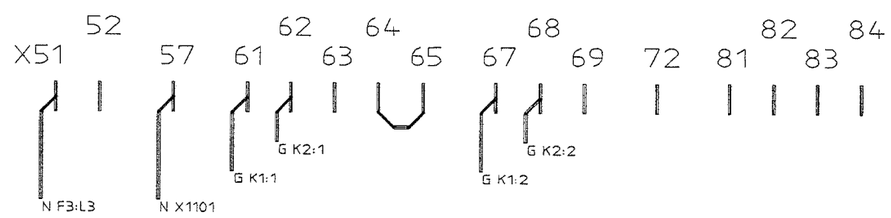
Y
High speed rotor control

Z2-13







A3/A3 94-10-07 Ost.
v00340

OPTIMUS (94.0)
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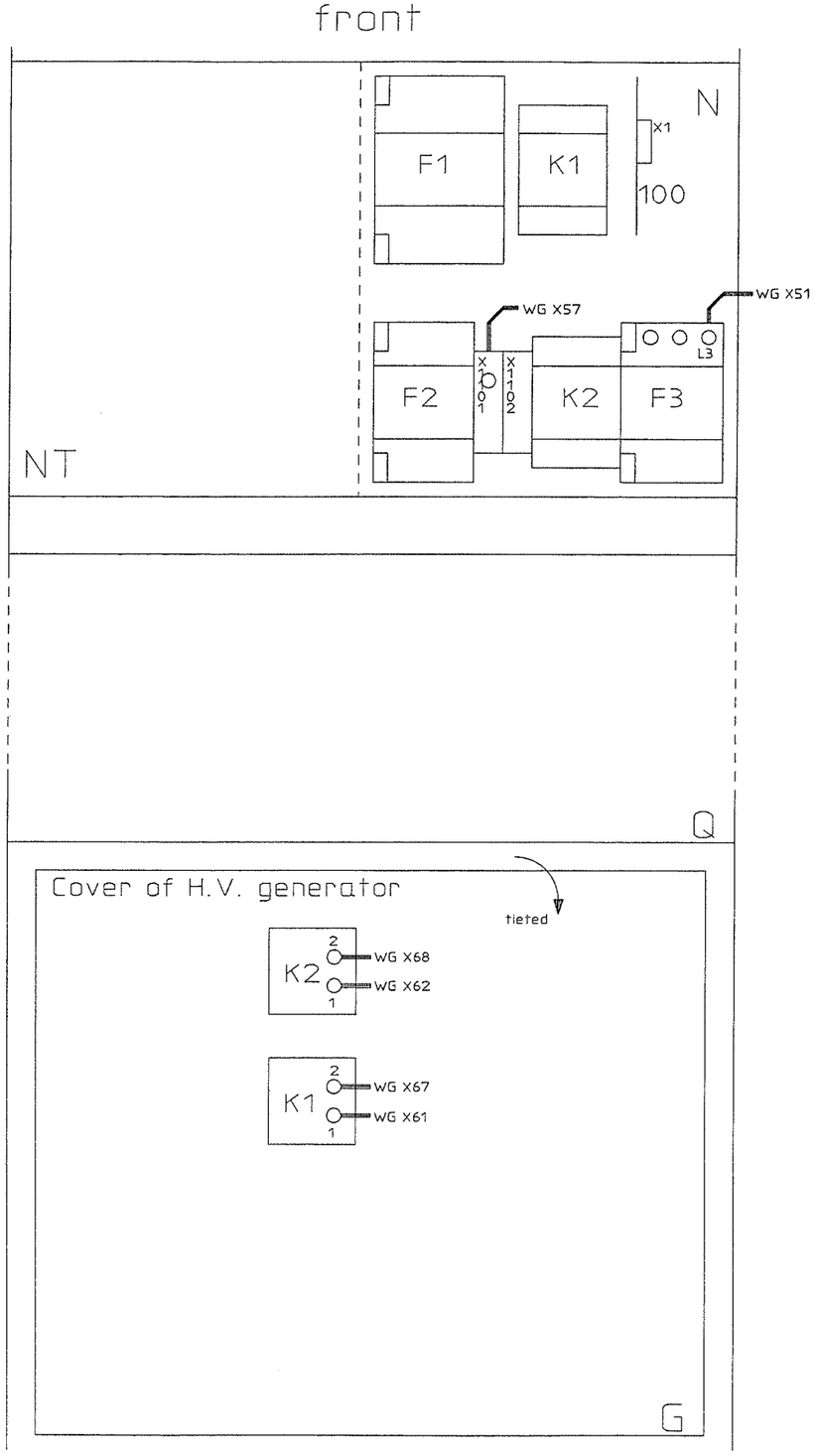
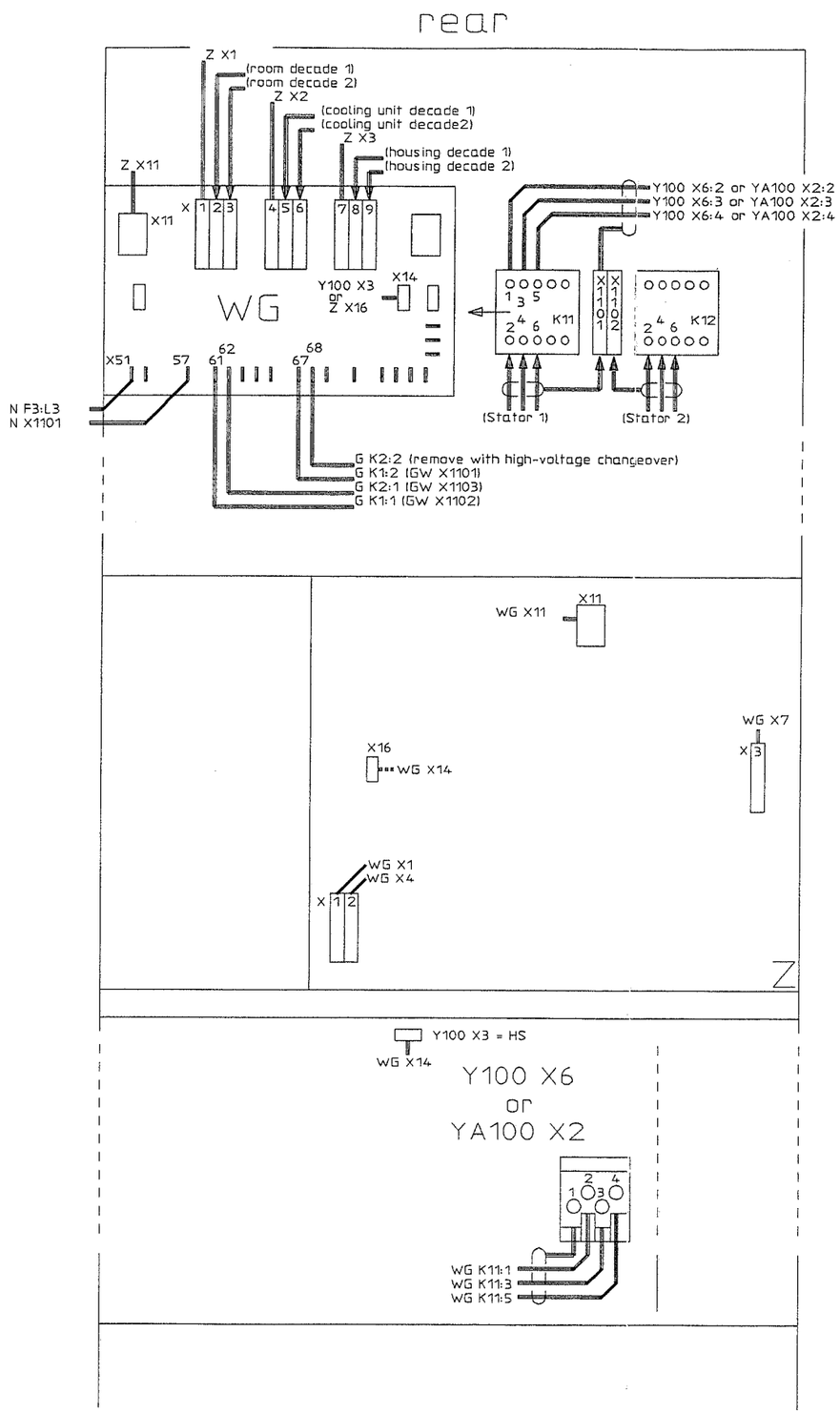
WG
Tube extension

Z2-14.1





A3/A3 94-10-07 Ost.
v00329

WG
Tube extension

Z2-14.2

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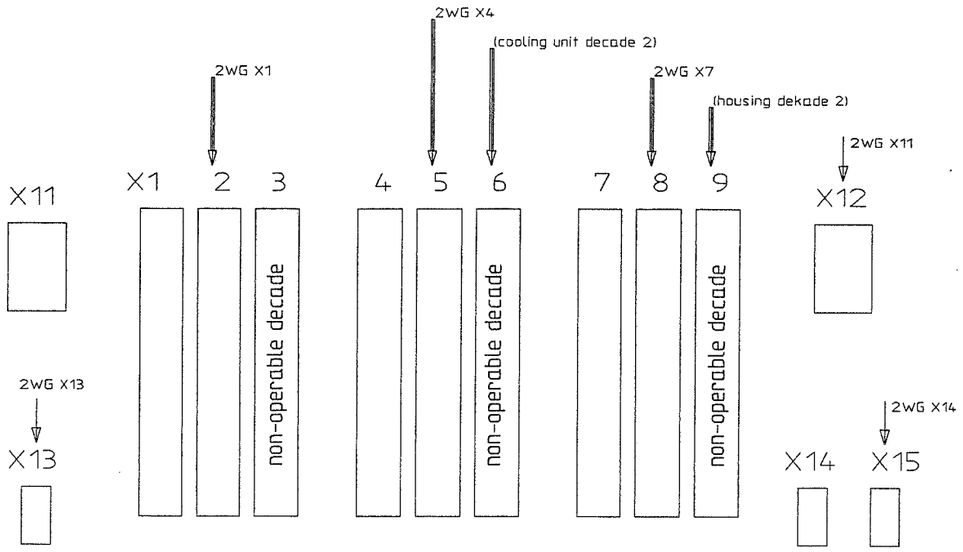

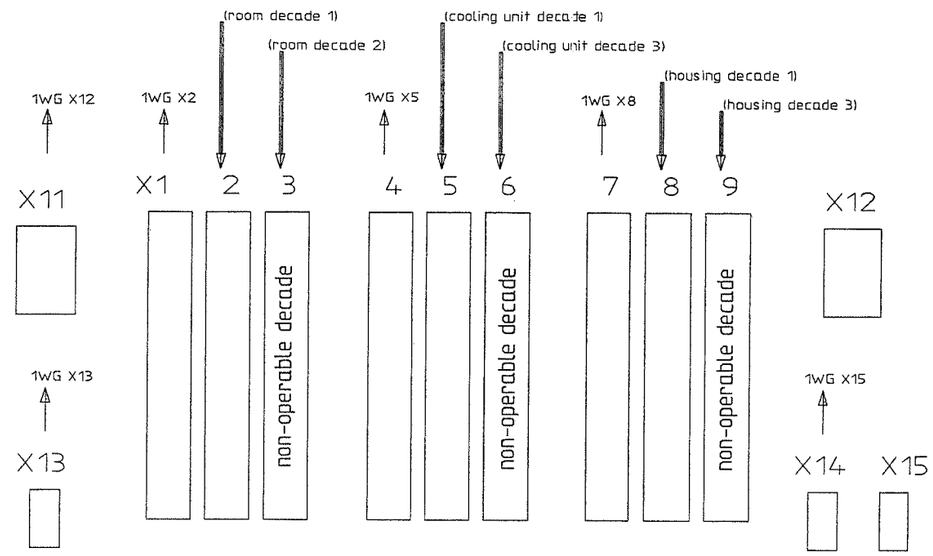

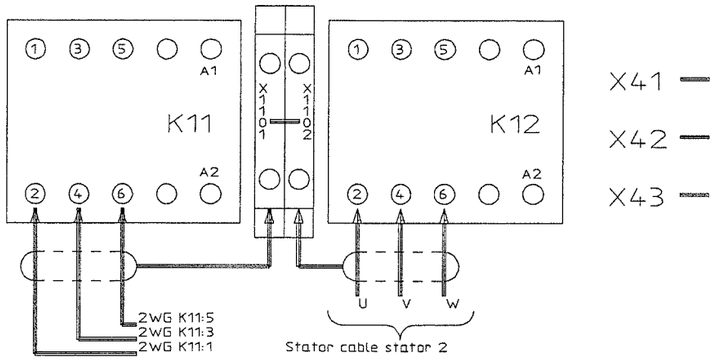

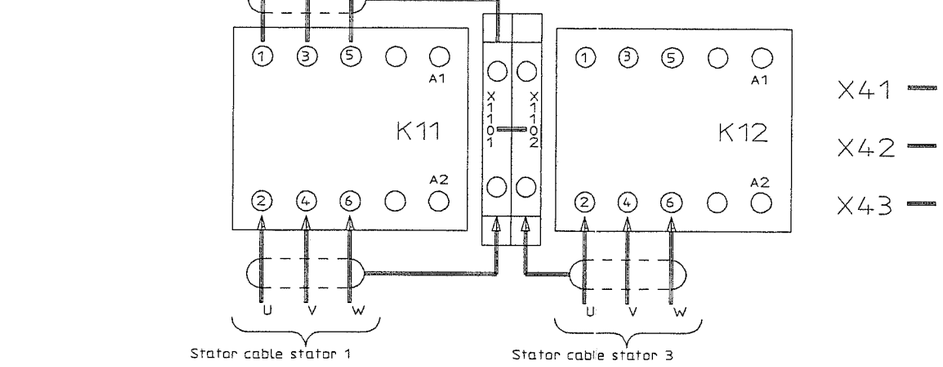

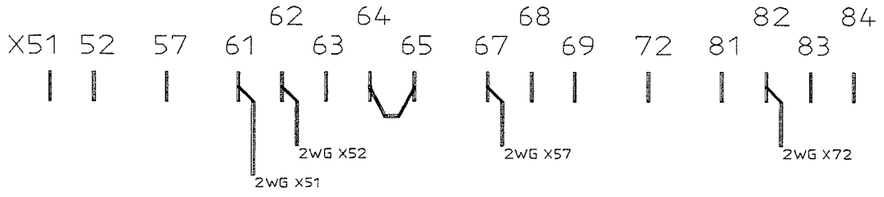

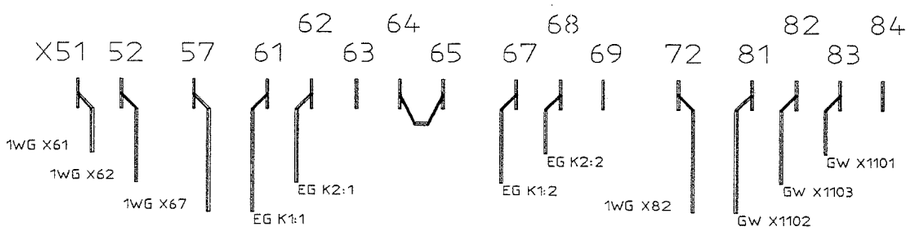

1WG 2WG

1WG/2WG
Tube extension

Z2-14.3

A3/A3 94-10-07 Ost.
v00341

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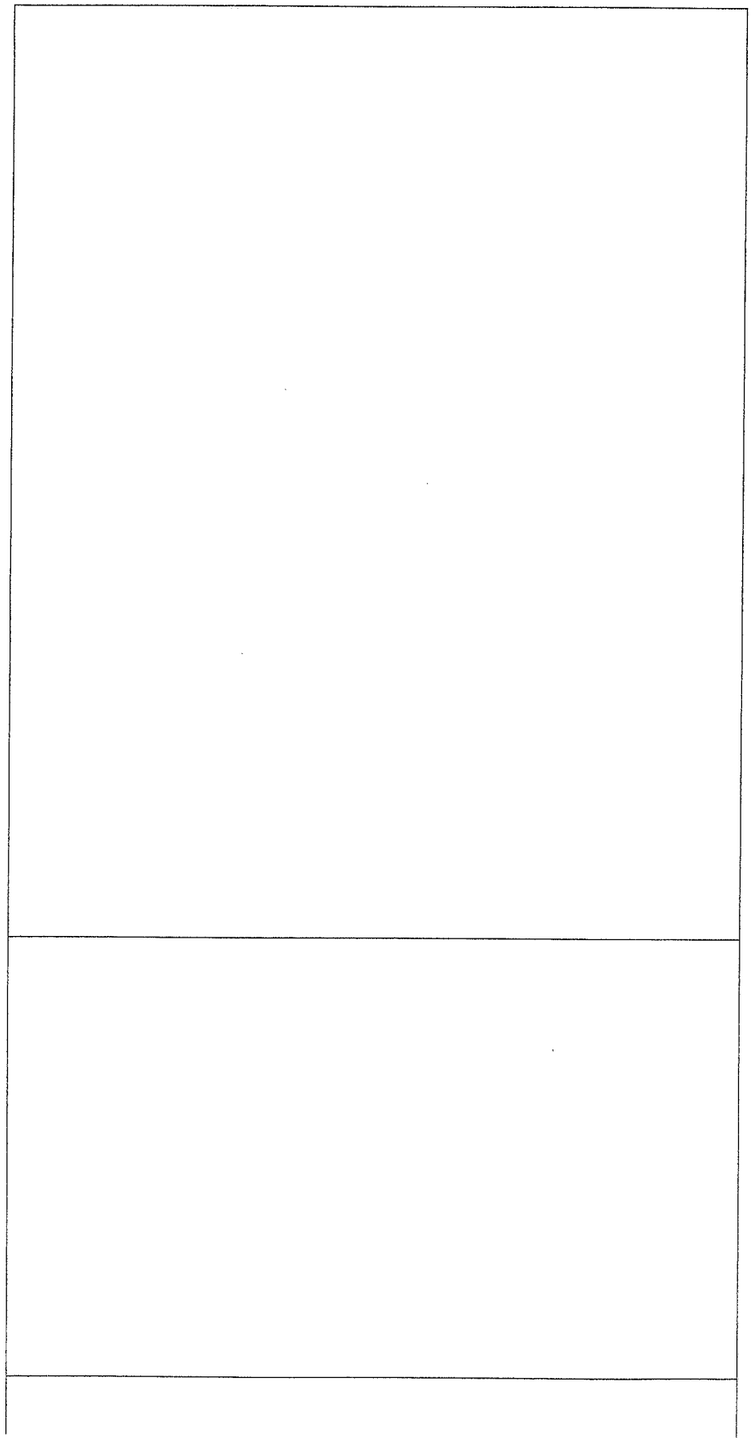
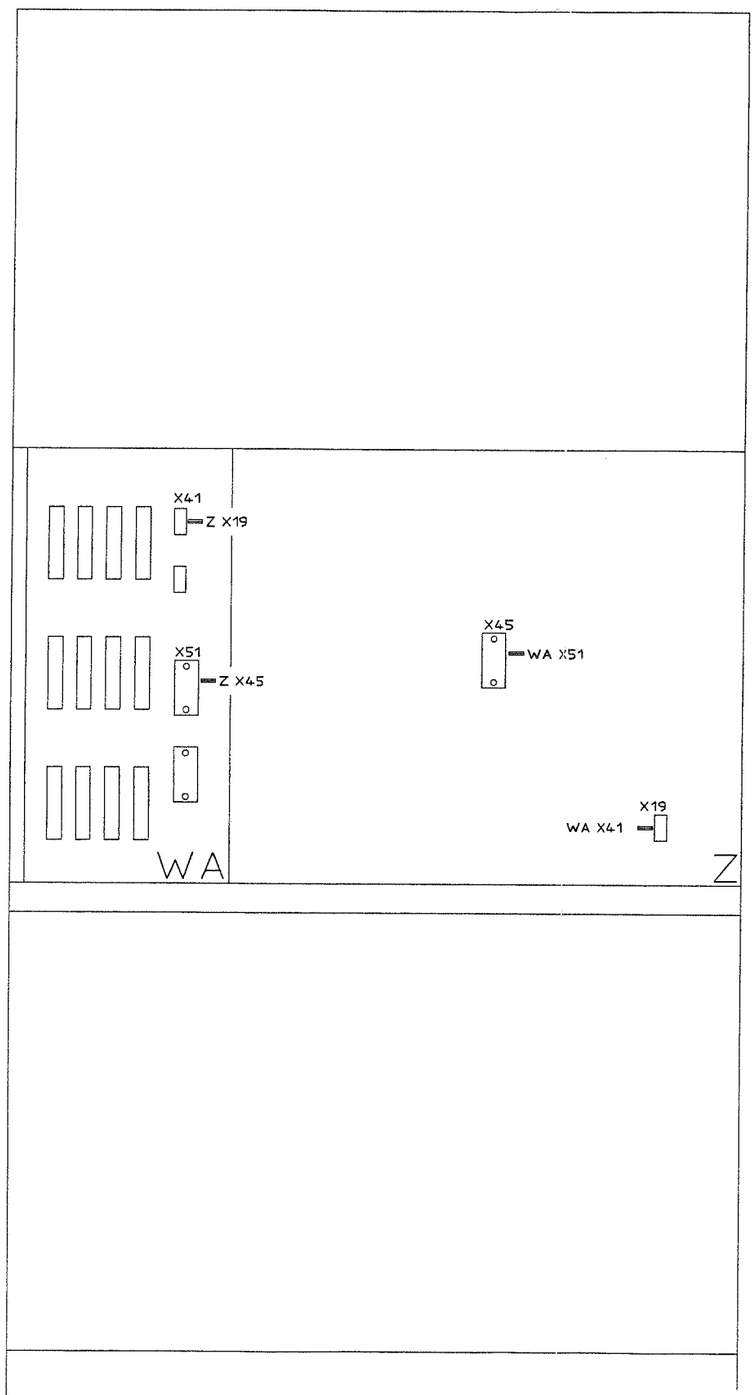
front



rear



A3/A3 94-12-14 Ost.
v00344

WA
Adapter 4 auxil. units

Z2-15.1

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